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REPORT

OF THE

Horticultural Experiment Station

VINELAND STATION
ONTARIO
1906 - 1915

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE)

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO

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REPORT

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Horticultural Experiment Station

1906-1915

To the Honorable James S. Duff, *Minister of Agriculture.*

Sir,—In submitting the following report it is desired to call attention to the fact that some mention is made of all work under way that is of an experimental or investigational nature. In many cases all figures available on the various subjects are not given, but it is hoped that from the outlines submitted in detail for a few experiments it will be possible to obtain an idea of the general plan and method of work. It is hoped also that this report may serve in a small way as a record of the work of the Station up to October 31st, 1915.

Yours very sincerely,

F. M. Clement,

Director.

STATION STAFF

F. M. Clement, *Director.*
F. S. Reeves, *Hybridist.*
O. J. Robb, *Assistant, Olericulture.*
P. E. Culverhouse, *Assistant, By-Products.*
A. G. Harris, *Assistant, Pomology.*

A View in the Experimental Plum Orchard at Horticultural Experiment Station, Vineland.

REPORT

OF THE

Horticultural Experiment Station

1906-1915

The Place of the Experiment Station and the Need for Definite Information.

The orchards, small fruits, vines and vegetables of Ontario represent an annual income of approximately $14,000,000 or more per annum. Nineteen hundred and eleven census gives $13,862,000 for the season of 1910. Recognizing that Agriculture, and then Horticulture as a part of agriculture, is the basis of our Provincial and National wealth, it is convincing without argument that laboratories for research, and fields for experiment, must be maintained if the highest efficiency is to be secured. This is the basis on which Experiment Stations are founded.

Horticulture has registered a marked advance in twenty years and is still advancing rapidly. The first Experiment Station of the United States was established in Connecticut following the year 1875. Canada passed a bill in 1886 appropriating the necessary money to establish the Central Experimental Farm and its branches. This was the beginning of the work as now organized in Canada.

Fruit Experiment Stations in 1901.

Name.	Specialty.	Experimenter.
1. Southwestern	Peaches	W. W. Hilborn, Leamington.
2. Niagara	Tender fruits	Martin Burrell, St. Catharines.
3. Wentworth	Grapes	Murray Pettit, Winona.
4. Burlington	Blackberries and currants	A. W. Peart, Freeman.
5. Lake Huron	Raspberries	A. E. Sherrington, Walkerton
6. Georgian Bay	Plums	J. G. Mitchell, Clarksburg.
7. Simcoe	Hardy apples and hardy cherries	G. C. Caston, Craighurst.
8. East Central	Pears and commercial apples	R. L. Huggard, Whitby.
9. Bay of Quinte	Apples	W. H. Dempsey, Trenton.
10. St. Lawrence	Hardy plums and hardy pears.	Harold Jones, Maitland.
11. Strawberry Station		E. B. Stevenson, Jordan Sta.
12. Gooseberry Station		Stanley Spillett, Nantyr.
13. Maplehurst	General collection of all kinds of fruits for descriptive work for "Fruits of Ontario"	L. Woolverton, Sec., Grimsby.
14. Algoma	Hardy fruits	C. Young, Richard's Ldg.
15. Wabigoon	Hardy fruits	A. E. Annis, Dryden.

The Fruit Experiment Stations of Ontario grew out of the report of a standing committee of the Ontario Fruit Growers' Association appointed for the purpose of formulating a feasible scheme for fruit experimental work. In 1894, five stations were established, assisted by Provincial funds and working in co-operation with the Ontario Fruit Growers' Association. The President of the Agricultural College, then Dr. James Mills, Prof. Hutt, Horticulturist at Guelph College; Mr. D. Nicol, Mr. A. M. Smith, and Mr. A. H. Pettit, and the Secretary of the Association, Mr. L. Woolverton, made up the first Board of Control. The first meeting is recorded as having been held in the President's office, O.A.C., Guelph, April 5th, 1894. The Stations were not provincially owned, but were established largely for variety testing and with the intention of making use of the special training and expert knowledge of some members of the Ontario Fruit Growers' Association working in co-operation with the Association, the Agricultural College and the Department of Agriculture. The reports are published in the Department of Agriculture Reports beginning 1894. In 1895, five more stations and two sub-stations were established, making in all twelve. Various other stations were established until by 1901 there were fifteen, situated as given above.

As the Vineland Station took over the work of these Stations, they were gradually discontinued until at the present time, Nos. 10 and 14 only are retained for testing out hardiness of varieties introduced from various sources.

The first report of the work of the Vineland Experiment Station appears in the Fruit Branch Report of 1908. The policy of the Department at this time was to concentrate more work at the Vineland Station, gradually withdrawing it, except in certain special cases, from the various stations that for years had been working in co-operation with the Ontario Fruit Growers' Association and the Fruit Branch of the Department of Agriculture. A high tribute must be paid the men who for many years with only meagre assistance struggled to collect data from their experiments. They laid the foundations of the present policy, and have made it possible for other men to take up the work, not where they abandoned it, but where they had built the foundations and collected the materials of construction. The policy to-day is to deal with special Horticultural topics in as specific a manner as possible, to have a specially trained man in charge of each branch—and as each experiment is concluded or each investigation brought to an end to publish the results under the particular head.

It is also the policy of the Department of Agriculture to publish and keep on file for distribution as occasion demands a complete list of practical bulletins dealing with special topics. No bulletins are published from this Station, all material being turned in to the Department of Agriculture at Toronto to be dealt with in the form of a regular Department bulletin.

Horticulture is sometimes spoken of as being a science, but perhaps it would be more correct to say that horticulture is based on a number of sciences, and that horticulture, as practised by the fruit grower, floriculturist, and olerist is an art. The art is based on the sciences. In spraying, we have both art and science. Science teaches us that certain steps taken at certain times with certain materials will give certain results. But practice has shown that there is an art in spraying as well as in writing or drawing. Certain men get marked results with little effort; others get poor results even after a large effort. Why? One understands the value of the nozzle elbow, the advantages and the disadvantages of winds or breezes and thoroughness and self protection from the spray. The other may know the science but is careless in his methods of application and hence the failure.

It is not yet proven that by pruning at a certain time in a certain way fruit buds will form. We can discuss winter, spring, summer, and fall pruning, but we cannot say what effect any special time of pruning will have on a tree except in a general way—winter pruning produces wood growth, summer pruning reduces wood growth; and spring wounds heal quicker than fall wounds. It is not yet proven that certain fertilizer constituents applied to the soil at the base of a tree will have a certain effect, but we can state that nitrogen increases wood growth and potash and phosphorous hasten maturity and improve the color of the fruit. It can be advised to experiment and see what the particular soil requires for the particular crop. General statements only can be made. Nor is it proven that certain cultural methods will produce high colored fruit in quantity or that cultivation at all is necessary when certain other practices are followed.

And so we might go on with the vegetables and all the fruits and discuss each one in turn at length and in the end it would have to be admitted that our present knowledge of the practice of horticulture and of the application of the sciences that underlie the practice is very meagre indeed.

The influence of stock on scion; the value of certain seedlings as roots for our cultivated apples, plums, and cherries; the relation of one variety to another for pollination purposes; the relation of pruning to fruit bud formation; the comparative value of the various insecticides and fungicides, are practical problems that can be tackled only in an experimental way. It is work such as this that is being undertaken.

At present, the whole trend of thought among experiment station specialists seems to be toward breeding problems and the production of new varieties. In this there is little to guide except recent bulletins from stations in United States and articles appearing in various journals and reports. Very largely the method of work must be determined as advance is made. Practical experience is, however, a good teacher and as time goes on information is being collected that assists materially.

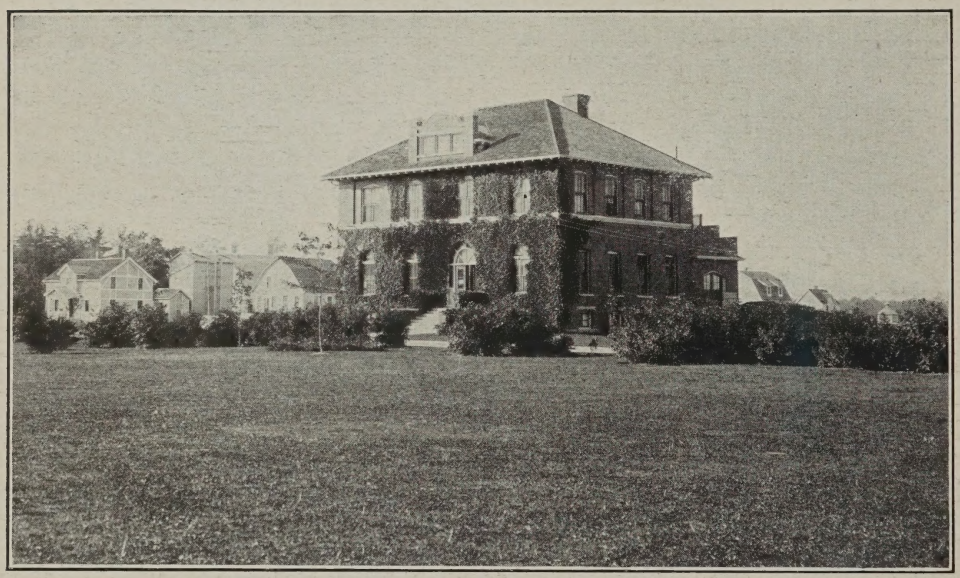
The call in recent years seems to have been largely for teaching and demonstration. The remarkable growth of the Agricultural College at Guelph and the establishment of the County Branches of the Department of Agriculture are the natural outgrowths of this. Extension teaching has been demanded and the time of the college specialist when not teaching in the College has, to a large extent, been taken up with demonstration work or in assisting District Representatives. Little time has consequently been left for experimental and investigation work. Yet investigation must precede demonstration. The work of a college is teaching first: the work of the experiment station is first and foremost—experimental and investigational.

THE REPORT OF THE DIRECTOR.

Part of the land that is now the Vineland Experiment Station was presented to the Ontario Government by M. F. Rittenhouse, of Chicago, in 1906. The balance of the property was purchased by the Provincial Government. A foreman was placed in charge and much of the cleaning up work was done at once. In 1907 the land was sown largely to oats or kept in a state of cultivation. In June of that year, the late Mr. H. S. Peart was appointed Director. Nearly eleven miles of underdrains were laid with the help of the Department of Physics, Agricultural

College, Guelph, in the summer and fall of that year. A draft of the proposed experimental work was presented to the Advisory Board in February of the following year and preparations were at once made to carry out the work. The farm was carefully laid out into blocks and all plantings were made looking well to the future. In this year also were erected the barn and the cold storage. The Administration Building and the Director's Residence were also placed well under way.

The late Mr. Peart was succeeded by Mr. A. D. Harkness as resident Superintendent, and Mr. A. J. Logsdail in charge of the Plant Breeding work. Mr. Logsdail resigned in 1911 to take a position as Hybridist and Assistant to the Dominion Horticulturist, Mr. W. T. Macoun, at Ottawa. In 1912, Mr. F. S. Reeves was appointed Hybridist to succeed him, which position is still held by him. Mr. Harkness resigned in the spring of 1914 to take up fruit farming. The work was reorganized and Mr. F. M. Clement was appointed to take charge.



Administration Building.

It was immediately recognized that if the work so carefully planned was to be carried to successful completion additional help must be secured. Mr. O. J. Robb was made assistant in Olericulture, Mr. P. E. Culverhouse, assistant in canning and the study of by-products, and Mr. A. G. Harris, assistant in Pomology. With this additional assistance, it has been possible to put the work on a better basis and to give to the various branches of the work the attention they deserve.

In summer, students are engaged to render the immediate assistance each specialist requires.

Present Needs.

The Farm is situated some distance from any large centre, the nearest village being Vineland, one and three-quarter miles away. Consequently, it is difficult to secure boarding places for students. To obviate this difficulty the Station has found it necessary to maintain a boarding house, "The Lodge." This has been

overcrowded for some time in spite of the fact that a sleeping camp has been arranged in the Administration Building. A dining-room 12¾ x 11½ has been made to accommodate from twelve to fifteen individuals during the summer months.

The need for a suitable Lodge, including rooms for the housekeeper and a comfortable sitting room, is imperative. The "camp" in the Administration Building has been reconstructed for use as a laboratory, and during the coming season, 1916, unless a change is made at once, it will be necessary to use the laboratory or to procure a large tent for temporary accommodation.

The Station has found it necessary to rent a double cottage some distance from the farm to accommodate two of the workmen. This, besides costing an annual rental, is the extreme of inconvenience to the men, who are sometimes required for work outside of the regular hours. Teamsters, greenhouse men and those in charge of light, water, and fire equipment must be near their work in order to maintain the highest efficiency. The construction of a suitable "Lodge" and an addition to the present one, so it would accommodate two families, would meet the present needs.

Administration Building, Director's Residence, and original building in 1908. The latter is now the "Lodge."

A great loss is also felt in the lack of greenhouse space and equipment. At present the Station has but one small glass house and two pit houses, which are entirely inadequate. Plant improvement through breeding and selection is demanding the most time and attention. The processes are delicate and require a great deal of patience and skill. Consequently the need of greenhouse space is urgent, where it will be possible to control wind, rain, and temperatures and the results will not be lost through adverse weather conditions. The greenhouse is to the modern plant breeder to a very large extent what the well equipped laboratory is to the chemist. He must have a place to work where plants and apparatus cannot be disturbed or work destroyed by adverse weather conditions. The orchard and garden are essential, but control conditions can be established only under glass.

The Station through its staff endeavors to render what assistance it can to the various fruit interests of the Province. Many meetings have been addressed

on various subjects. Whenever it is impossible to give the desired information by letter or by telephone in the immediate locality, an endeavor is made to visit the farm or put the inquirer in touch with the District Representative of the county.

During the past two years display exhibits have been made at the Toronto National Exhibition and at the Local Fair held at Beamsville. These received very favorable comment.

Until the present time, properly equipped laboratories have not been provided, but now the necessary funds are available. The work of reconstructing and refitting will be completed by the spring of 1916.

Bridge on the Rittenhouse Road.

No attempt has yet been made at co-operative extension work, but plans have been laid and are discussed in connection with the work mentioned in the pages that follow.

It is desired to impress on the public that the Experiment Station is not a fruit farm in the general understanding of the word. In its true sense it is a working laboratory equipped and maintained for experimental and investigation purposes. The profits are consequently expressed in experimental results, not in dollars and cents. The farm is at all times kept as clean, neat and tidy as is practicable in a well kept laboratory, and an honest endeavor is made to make the work of practical value to the Province.

PLANT BREEDING

TREE FRUITS.

Apples.

The first work on apples was done in the spring of 1915. An attempt was made to test the various common varieties as pollenizers of the Northern Spy, but adverse weather conditions spoiled the results in most cases. From fruits gathered from crosses made for pollination tests the following good seeds have been saved:

Cross.	No. fruits.	No. good seeds.	No. of undeveloped seeds.
Spy x Wealthy	5	54	4
Spy x Duchtess	3	21	1
Spy x McInosh	2	26	7
Spy x Ben Davis	3	25	3
Spy x Fameuse	3	13	0
Spy x Greening	1	4	0
Spy selfed	1	0	0

The Rittenhouse Road.

Cherries.

Attempts have been made at different times to grow cherry seedlings, but results have been, up to the present, very discouraging. The following are, however, at present growing in the nursery rows:—

Montmorency	14	Black Tartarian	122
Reine Hortense	6	Napoleon	19
Elkhorn	92	Cherry No. 5	3
Early Richmond	5	Windsor	17
Coe Transparent	494	Prunus serotina	483

Seeds have also been secured for a continuation of this work, as noted in the following list:—

Windsor	6,400	English Morello	2,500
Montmorency	6,000	Black Tartarian	600
Late Duke	2,800		

Peaches.

The work with peaches began with the transplanting of 53 seedlings from pots in the greenhouse to the field in very late spring of 1912. Only a part of these are of known origin, being St. John and New Prolific seedlings. During the fall of that year, pits were collected of Greensboro, Admiral Dewey and Early Crawford. The Admiral Dewey and Greensboro failed to germinate, but from the Early Crawfords were produced 1,040 seedlings plants.

In the spring of 1913 the following pollinations were made:—

Cross.	Pollination.	Fruits gathered.
Greensboro x Early Crawford	50	2
Greensboro x Elberta	140	12
Greensboro x Yellow St. John	240	46
Yellow St. John x Sneed	203	32
Elberta x Early Crawford	230	69
Early Crawford x Greensboro	258	48

A number of varieties were self-fertilized. A half-pound paper sack was used and an average of three buds was enclosed under each sack. The following is the list of varieties selfed:

Variety.	Sacks applied.	Fruits gathered.
Greensboro	64	127
Yellow St. John	130	54
Elberta	100	110
Early Crawford	138	16
New Prolific	100	182
Late Crawford	12	8
Fitzgerald	100	52
Millionaire	25	12
Klondyke	40	27
Leamington	50	94
Golden Drop	50	85
Admiral Dewey	36	20
Crosby	30	45
Smock	45	39

In the spring of 1914, from the 1,040 Early Crawford seedlings, 993 were set out in the field. They have made very satisfactory progress. The pits from the cross-bred fruits of 1913 were layered out-of-doors for the winter. They were taken up in February, cracked by hand and planted in flats in the greenhouse. The following table will give data with regard to these pits:

Transverse.	No. Poll.	No. fruit gath-ered.	How pits wintered.	Date of planting.	No. Plant-ed.	No. Germ-inated	No. trans-plant-ed to field.	Date of transplanting to field.	Remarks.
Crossed.									
Greensboro x E. Crawford...	50	2	Outside in soil in pots W. of vinery	Feb. 6, 1914..	.....	.....	.....	.....	Seeds rotten.
Greensboro x Elberta.....	140	12	" "	"	.....	.....	.....	.....	"
Greensboro x Yellow St. John	240	46	" "	"	.....	.....	.....	.....	"
St. John x Sneed.....	203	32	" "	"	8	4	3	May, 1914	Remainder seeds rotted during winter.
Elberta x E. Crawford.....	230	69	In flats on school plot.....	Mar. 16, 1914 .	53	7	6	"	
Early Crawford x Greensboro	258	48	Outside in pots W. side of vinery.	Feb. 6, 1914...	34	15	15	"	Remainder seeds rotted during winter.
Selfed (sacks applied).									
Greensboro	64	127	" "	"	.....	.....	.....	.....	All rotten. 1 sack applied on an average covered [3 buds.
Yellow St. John	130	54	" "	"	24	6	6	May, 1914	
Elberta.....	100	110	In flats on school plot.....	Mar. 16, 1914 .	98	11	6	"	
Early Crawford	138	16	Outside in pots W. of vinery..	Feb. 6. 1914 ..	6	4	4	"	Remainder seeds rotten.
Late Crawford	12	8	" "	"	5	4	4	"	The 5 seeds were from 4 pits. 4 pits of split [stones all rotten.
Fitzgerald	100	52	" "	"	47	22	21	"	
Millionaire.....	25	12	" "	"	5	3	3	"	
Klondyke	40	27	" "	"	12	6	6	"	
Leamington	50	94	" "	"	114	61	59	"	Most pits contained 2 seeds —about 6 only rotten.
Dewey.....	36	20	" "	"	.....	.....	.....	.....	All rotten.
New Prolific	100	182	In flats on school plot.....	Mar. 6. 1914 ..	229	17	10	May, 1914	Large percentage of pits contain 2 seeds.
Crosby.....	30	45	" "	"	53	4	2	"	
Smock.....	45	39	" "	"	26	.....	.....	.....	
Golden Drop	50	85	" "	"	103	9	1	May, 1914	

Much trouble has been experienced in preserving the seeds over winter and also in germinating successfully even when well preserved. The kernels from many crosses, and especially from selfed varieties, are small and shrivelled and will not grow; consequently we have but a small number of seedlings compared to the number of pollinations made.

Owing to the failure of the peach crop in 1914 no crosses were made. An attempt was made to do some of this work in the orchards at Leamington, but adverse weather conditions gave little or no opportunity of work. The following is a list of the hybrids referred to previously that are now growing in the field:—

Crossed.

Early Crawford x Greensboro	15	
Elberta x Early Crawford	6	
St. John x Sneed	3	

Selfed.

Millionaire	3	
New Prolific	16	(Six of these, owing to slow germination, were held in pots all last season, hence do not appear in last year's list as having been transplanted to the field.)
Leamington	59	
Fitzgerald	21	
Late Crawford	4	
Early Crawford	4	
Elberta	9	(Three of these, owing to slow germination, were held in pots all last season, hence do not appear in last year's list as having been transplanted to the field.)
Crosby	2	(Two of these, owing to slow germination, were held in pots all last season, hence do not appear in last year's list as having been transplanted to the field.)
Golden Drop	6	(Five of these, owing to slow germination, were held in pots all last season, hence do not appear in last year's list as having been transplanted to the field.)
St. John	7	(One of these, owing to slow germination, was held in pot all last season, hence, does not appear in last year's list as having been transplanted to the field.)

The peach pits secured from the work in Leamington last season were planted and the following is a list of the number germinated and growing at the present time:—

Selfed.

Golden Drop	2	Kalamazoo	2
Banner	7	Tyhurst's seedling No. 2	6
Tyhurst's Favorite	13		

The work of peach crossing for the season of 1915 was started with much interest and plenty of help. In order to do the work in as large a way as possible and to eliminate the task of removal and replacement of the paper sack as commonly used, a method of covering the whole tree was devised. A temporary frame was built about the tree and covered with oiled cotton. It was hoped in this way to protect the tree from foreign pollen, and then to emasculate all blossoms and to pollinate with one variety only. Unfortunately, the peculiar season was adverse to this work. During the middle of the day when the sun was hot, the temperature within the tents rose several degrees above the outside temperature. The temperature at the end of April was abnormally high and consequently the heat within the tents was excessive. All efforts were made to keep the air cool, even to the

The frame used when covering trees for hand pollination purposes. Oiled cotton was placed over this.

extent of putting ice inside the tents, but it was impossible to keep the temperature low enough for pollination purposes. The following crosses were made:—

Whole tree under oiled cotton tent E. Crawford x Greensboro.
" " " E. Crawford x Dewey.
" " " St. John x Greensboro.
" " " St. John x Dewey.
" " " Elberta x E. Crawford.

The following table shows the temperature during the days the blossoms were ready for pollination:—

April 29th—inside, 80 F.; outside, 65 F.; bright sunshine.
May 1st—inside, 60 F.; outside, 50 F.; dull.
May 3rd—inside, 78 F.; outside, 47 F.; bright sunshine.
May 4th—inside, 48 F.; outside, 42 F.; dull and rain.
May 5th—inside, 68 F.; outside, 62 F.; dull and rain.
May 6th—inside, 83 F.; outside, 70 F.; bright and sunshine.

PEACHES, 1915

Cross	No. Poll.	Date Poll.	No. fruits set	Removal of tent	No. fruits gathered	Remarks
E. Crawford x Greensboro	264	May 4....	.....	May 11...	0	Tree, leaves and fruit seem to be burned under tent.
E. Crawford x Dewey...	633	" 4....	.....	" 11...	45	
St. John x Greensboro ..	318	" 4....	.....	" 11...	1	
St. John x Dewey.....	642	" 4....	.....	" 11...	35	
Elberta x E. Crawford..	254	" 4....	.....	" 11...	1	
E. Crawford x Greensboro	206	" 11....	.....	Sacks used	15	Gathered when fruit quite green and hard, as tree was blown down and cut off.
Dewey x $MgCO_3$	51	" 11....	24	" "	0	Stimulation test S.W. side of tree.
Dewey x S	100	" 11....	34	" "	1	Stimulation test N.W. side of tree.
Dewey x $CaSO_4$	88	" 11....	47	" "	0	Stimulation test E. side of tree.
Dewey selfed.....	100	" 7....	60	" "	35	Simply covered before buds opened.
Dewey selfed.....	108	" 10....	61	" "	0	Pollinated with pollen from same tree—not emasculated.
Dewey.....	100	" 7....	32	" "	1	Emasculated and left so.
Dewey.....	100	" 7....	31	" "	0	Mutilated and left so. Pistil removed as well as emasculated.
Dewey x $MgSO_4$	102	" 11....	38	" "	0	Stimulation test N.W. side of tree.
Dewey x $MgCO_3$	47	" 11....	14	" "	1	Stimulation test E. side of tree.
Dewey x $CaCO_3$	75	" 11....	38	" "	0	Stimulation test S. side of tree.
Greensboro selfed.....	100	" 4....	48	" "	5	Simply covered before blooms opened.
Greensboro selfed.....	83	" 6....	47	" "	2	Pollinated with pollen from same tree—not emasculated.
Greensboro.....	100	" 4....	0	" "	0	Emasculated and left so, S. side of tree.
Greensboro.....	100	" 4....	0	" "	0	Mutilated and left so. Pistils removed as well as emasculated.
Greensboro x $MgSO_4$	39	" 11....	0	" "	0	Stimulation test N.W. side of tree.
Greensboro x $MgCO_3$	40	" 11....	1	" "	0	Stimulation test E. side of tree.
Greensboro x $CaSO_4$	37	" 11....	0	" "	0	Stimulation test W. side of tree.
Greensboro x $CaCO_3$	41	" 11....	0	" "	0	Stimulation test middle of tree.
Greensboro x S.....	25	" 11....	0	" "	0	Stimulation test S. centre of tree.

With the hope that an opportunity may be given to do a large amount of the breeding work under glass in the near future, the following varieties have been budded on the dwarfing stock (*Prunus pumila besseyi*) :—

November, 1915.

Elberta	2	Golden Drop	3
Smock	6	Brigdon	2
Leamington	4	Lemon Free	2
Wellington	3	New Prolific	1
Old Mixon	3	Niagara	1
Carman	2	Crosby	3
Hill Chili	3	Salway	3
Early Crawford	3	St. John	1
Mayflower	4	Fitzgerald	2
Greensboro	4	Blood peach from Tyhurst, Leamington	1
Triumph	3	Sneed	4
Klondyke	3	Alexandria	3
Admiral Dewey	6	Edgemont	3

PEARS.

The following table outlines the pear work of 1914:

Cross.	Pollinations.	No. of fruits set.	No. fruits gathered.	No. good seeds.	No. undeveloped seeds.	How seeds wintered.
Bartlett x Kieffer	58	2	2	12	8	Layered in sand and buried 6 inches deep. Covered late with a mulch, and frame before severe freezing.
Bartlett x Le Conte	73	.....	.....	.....	.....	
Bartlett x Seckel	65	.....	.....	.....	.....	
Bartlett x Bessemianka	81	17	16	148	14	
Bartlett x Gliva Kurskaya	15	.....	.....	.....	.....	
Bartlett x communis (from Jordan)	77	21	18	144	24	
Anjou x Kieffer	44	7	7	51	15	
Anjou x Le Conte	47	6	6	44	16	
Anjou x Gliva Kurskaya	10	.....	.....	.....	.....	
Anjou x Bessemianka	11	1	1	10	.....	
Anjou x Seckel	36	8	6	52	8	
Anjou x P. communis (from Jordan)	14	2	2	18	2	
Kieffer x Anjou	64	31	16	122	28	
Kieffer x Bartlett	61	33	27	179	60	
Kieffer x Seckell	73	42	34	249	60	
Kieffer x Le Conte	61	33	27	207	37	
Kieffer x Bessemianka	65	2	1	5	5	
Kieffer x Tonkavietka	63	1	.....	.....	.....	
Kieffer selfed	50 (about)	.....	.....	.....	.....	
Bartlett selfed	50	1	.....	.....	.....	
Seckel x Bessemianka	36	.....	.....	.....	.....	
Seckel x Tonkavietka	66+90+67	.....	.....	.....	.....	
Seckel x Gliva Kurskaya	15	1	1	5	5	
Seckel x Kieffer	100	70	64	469	165	
Seckel x Le Conte	108	15	13	5	121	
Seckel x Bartlett	42	34	34	260	48	
Seckel x Anjou	50	32	29	208	56	
Seckel selfed	60 (about)	53	16	.....	138	
	1,660	412	320	2,188	810	

Out of this total of 2,188 seeds the following are growing in the nursery row:

Kieffer x Seckel	27	Anjou x Seckel	27
" x Le Conte	1	" x Bessemianka	2
" x Bartlett	5	Seckel x Kieffer	4
" x Anjou	14	" x Bartlett	8
Anjou x Kieffer	13	" x Anjou	5
" x Le Conte	17	Bartlett x Bessemianka	3
" x P. Communis	10	Pyrus communis seedlings	34

From the open fertilized seeds the following are growing in the nursery row:

Kieffer	74 seedlings.
Flemish Beauty Seedlings	27
Bartlett Seedlings	202

The open fertilized seeds at present bedded and that should germinate next year are approximately:—

Kieffer	3,500
Anjou	3,500
Clairgeau	200

The following table summarizes the pear hybridizing work in 1915:—

Cross	No. Poll.	No. fruit set	No. gathered	No. good seeds	No. undeveloped seeds	Remarks
Duchess x Tonkavietka	87	14	9	20	66	3 fruits had no developed seeds.
" x Gliva Kurskaya	85	1	1	0	10	
" x Besseminka	98	8	7	21	49	1 fruit had no developed seeds.
" x Bartlett	85	1	0	.....	.....	
" x Self	69	0	.....	.....	.....	
" x Clapp	73	6	3	7	22	
" x Kieffer	83	17	13	13	106	7 fruits had no developed seeds.
" x Anjou	74	2	2	8	10	
" x Seckel	80	0	.....	.....	.....	
" x Sheldon	100	9	7	29	40	
" x Bosc	62	1	1	1	8	
Winter Nelis x Kieffer	52	15	5	17	18	
Clapp's x Comice	24	3	3	15	11	
Comice x Clapp's	22	3	0	.....	.....	
Bartlett x Tonkavietka	126	31	16	74	67	
" x Gliva Kurskaya	99	5	1	2	8	
" x Sheldon	105	35	8	30	36	2 fruits had no developed seeds.
" x Bosc	140	76	40	171	153	4 fruits had no developed seeds.
" x Seckel	103	1	0	.....	.....	
" x Anjou	110	66	25	162	56	
" x Bessemianka	65	21	12	50	52	2 fruits had no developed seeds.
" x Clapp's	133	43	17	39	100	5 fruits had no developed seeds.
" x Kieffer	73	15	5	20	25	
" x Self	114	2	1	2	8	
Total	2,062	375	176	681	845	

Plums.

The work with plums was started in 1913 as shown by the following table:

Crosses	Pollinations	Fruit Gathered
Lombard x Hand	400	.....
Yellow Egg x Reine Claude	344	14
Grand Duke x Hand	411	2
Yellow Egg selfed	75	5
Grand Duke selfed	140	.....

From these seeds only three plants, Yellow Egg x Reine Claude, have survived, and these have made but poor growth.

The following is a summary of the work done in 1914:—

Cross	No. of sacks applied	No. Pollinations	Fruit Set	Fruit gathered	Seeds wintered
Greengage x Coe	30	96	0	.....	Layered in sand and buried 6" deep. Covered later with a mulch and frame before severe freezing.
" x Lombard	23	68	4	4	
" x Selfed	20	.....	0	.....	
" x Yellow Egg	20	99	20	14	
" x Prunus nigra	22	101	0	.....	
" x General Hand	21	49	0	.....	
" x Grand Duke	20	63	3	2	
Coe x General Hand	20	121	1	0	
" x Yellow Egg	20	108	2	1	
" x Washington	22	96	0	.....	
" x Green Gage	26	189	0	.....	
" x selfed	20	.....	0	.....	
" x Prunus nigra	7	23	0	.....	
" x Grand Duke	23	95	12	8	
Washington x Yellow Egg	22	89	4	0	
" x Coe	29	78	7	2	
" x Grand Duke	28	97	19	4	
" x Lombard	24	98	24	3	
" x General Hand	22	61	1	0	
" x Prunus nigra	20	.....	0	.....	
" x selfed	20	.....	0	.....	
Lombard x Yellow Egg	21	200	25	25	
" x Grand Duke	20	87	12	12	
" x General Hand	20	90	12	10	
" x Coe	19	78	4	4	
Reine Claude x Coe	9	15	1	1	
" x Yellow Egg	46	61	2	1	
" x Grand Duke	29	56	7	5	
" x General Hand	22	47	4	4	

A large number of seeds from common varieties were saved, the following of which are growing at the present time:

Prunus nigra seedlings	94	Reine Claude seedlings	28
Yellow Egg seedlings	119	Gueii seedlings	11
Coe's Golden Drop seedlings	89	Lombard seedlings	30
German Prune seedlings	35	Monarch seedlings	17

Owing to the poor results obtained in germination in the past or the method of layering in sand in the winter and taking up and planting in the nursery rows in the spring, a different plan has been adopted. They were planted two inches deep and two inches apart each way in a narrow bed about three feet wide. This bed is mulched for the winter and will be uncovered in the spring, but it is the intention not to disturb the pits.

From the former mentioned crosses but two trees are left, both Yellow Egg x Reine Claude, the rest having succumbed either to weakness or disease.

From crosses made in 1914 the following are the results:

Cross.	Fruit gathered.	Germination.
Greengage x Lombard	4	2
Greengage x Yellow Egg	14	0
Greengage x Grand Duke	2	1
Coe x Yellow Egg	1	0
Coe x Grand Duke	8	3
Washington x Coe	2	0
Washington x Grand Duke	4	1
Washington x Lombard	3	0
Lombard x Yellow Egg	25	8
Lombard x Grand Duke	12	2
Lombard x General Hand	10	1
Lombard x Coe	4	2
Reine Claude x Coe	1	0
Reine Claude x Yellow Egg	1	0
Reine Claude x Grand Duke	5	0
Reine Claude x General Hand	4	0

These are ready to be transplanted to the field in the spring of 1916.

The cross-breeding of 1915 is outlined in the following table:—

Cross.	No. Poll.	Date Poll.	No. Set.	Date of removal of tent.	No. fruits gathered.	Remarks.
Shiro x P. simonii	2,563	May 1	0	May 8	0	Most of the pistils dead at time of removal of tent.
Reine Claude x Coe	905	May 1	5	May 10	5	
Reine Claude x Yellow Egg.	838	May 1	4	May 10	4	
Washington x Yellow Egg.	282	May 3	8	May 10	8	
Washington x Coe	465	Aay 3	12	May 10	12	
Lombard x Hand	184	May 3	51	May 10	49	
Lombard x Grand Duke	281	May 3	65	May 10	65	
Yellow Egg x Washington	195	May 3	14	May 10	11	
Yellow Egg x Reine Claude.	150	May 3	2	May 10	1	
King of the Damson x Bradshaw	1,276	May 5	52	May 10	52	Most of the pistils dead at time of removal of tent.

Grapes.

With the exception of strawberries, more attention has been given to grapes than possibly any other of the fruits. The following table is a summary of the crosses made in 1913:—

Hybrid of	No. plants set out June, 1914.	No. plants alive Sept., 1914.	No. plants alive April 1915.	No. plants alive Aug. 25th.
Agawam x Concord	72	20	19	18
Agawam x Campbell	81	60	56	51
Agawam x Worden	170	100	99	86
Agawam x Niagara	65	11	5	4
Herbert x Concord	7	5	5	5
Herbert x Niagara	3	3	3	3
Herbert x Worden	23	10	10	10
Barry x Worden	79	42	40	36
Barry x Concord	51	44	44	43
Barry x Niagara	6	5	5	5
Massasoit x Concord	158	94	97	99
Massasoit x Worden	172	139	140	129
Massasoit x Niagara	36	26	21	23
Lindley x Niagara	60	22	20	18
Lindley x Worden	105	54	58	46
Lindley x Campbell	145	134	131	93
Lindley x Concord	120	83	82	78
Wilder x Concord	45	34	33	32
Wilder x Worden	18	11	9	9
Mixed: Lindley x Champion, Wilder x Niagara, Lindley x Winchell	108	71	64	66
	1,524	968	941	854

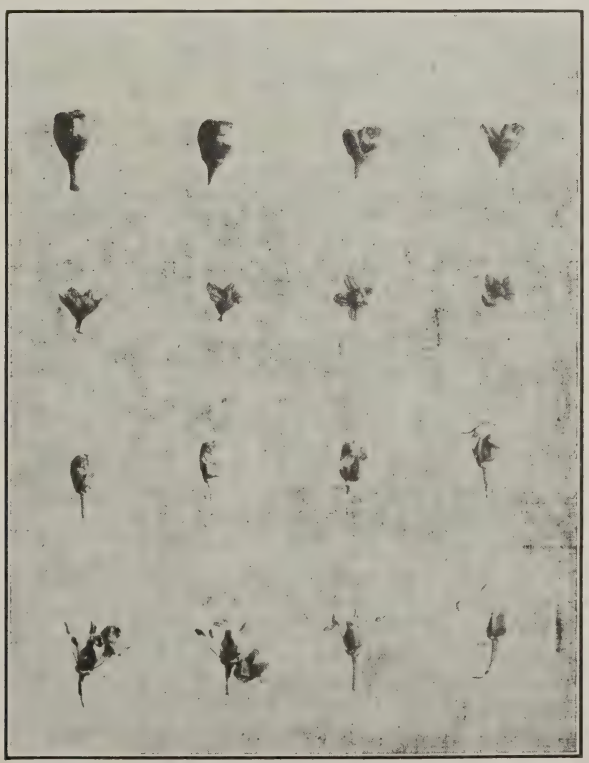
Seedling of	No. plants set out June, 1914.	No. plants alive Sept., 1914.	No. plants alive April, 1915.	No. plants alive Aug. 25th.	
Concord	230	122	94	99	
Niagara	590	392	339	301	
Moore Early	36	19	17	20	
Herbert	447	342	316	311	
Hicks	451	252	204	183	
Barry	425	261	250	243	
Catawba	537	274	262	227	
Aminia	247	84	76	83	revived
Champion	266	60	59	57	
Banner	167	44	35	34	
Campbell	26	9	6	5	
Massasoit	403	195	177	188	revived
Lindley	783	258	213	221	revived
Winchell	221	60	46	42	
Moyer	112	32	23	29	revived
President	83	23	13	15	
Sauvignon Juane	62	27	11	1	
Chasselas avec Royal	201	77	33	2	
Lady	640	229	205	184	
Worden	244	38	34	27	
Vergennes	290	114	59	71	revived
McPike	533	127	63	97	revived
Colerain	18	5	5	5	
Merrimac	5	0	0	0	
	7,017	3,046	2,540	2,445	

From pollination work done in 1914 and from open fertilized seeds secured in that year, the following plantings were made in the spring of 1915:—

Cross	Seeds planted	No. Germ.	% of Germ.
Barry x Concord	1,872	380	20.30
Concord selfed	1,188	14	1.17
Concord x Muscat of Alexandria	60	0	0
Campbell x Unk. Vinifera	96	0	0
Campbell x Muscat of Alexandria	168	1	.60
Worden x Unk. Vinifera	48	0	0
Worden x Muscat of Alexandria	156	8	5.12
Worden selfed	168	3	1.78
Niagara x Muscat of Alexandria	48	2	4.16
Niagara x Unk. Vinifera	48	10	20.83
Lady Downes x Concord	7	0	0
Barry x Campbell	1,308	43	3.28
Barry x Niagara	1,584	26	1.64
Barry x Delaware	792	120	15.15
Barry x Winchell	504	1	.19
Aminia x Campbell	696	215	30.88
Aminia x Niagara	828	120	14.49
Aminia x Worden	432	60	13.88
Vergennes x Campbell	756	43	5.68
Vergennes x Delaware	600	45	7.50
Vergennes x Worden	288	30	10.41
Vergennes x Niagara	288	40	13.88
Vergennes x Winchell	456	50	10.96
Massasoit x Campbell	720	235	32.63
Massasoit x Niagara	792	240	30.30
Massasoit x Concord	792	307	38.76
Salem x Champion	396	0	0
Salem x Delaware	552	16	2.9
Lindley x Muscat of Alexandria	108	5	4.63
Lindley x Unk. Vinifera	144	34	23.61
Lindley x Worden	360	10	2.77
Lindley x Winchell	456	180	39.47
Lindley x Champion	504	112	22.22
Lindley x Concord	696	154	22.12
Lindley x Niagara	288	95	32.90
Lindley x Delaware	420	0	0
Lindley x Campbell	300	150	50.00
Herbert x Muscat of Alexandria	120	0	0
Herbert x Winchell	432	2	.46
Herbert x Delaware	504	45	8.90
Herbert x Niagara	1,152	52	4.51
Herbert x Worden	552	82	14.85
Herbert x Campbell	1,980	537	27.12
Herbert x Champion	1,152	28	2.43
Herbert x Concord	1,116	269	24.10
Winchell selfed	324	0	0
Wilder x Worden	1,872	154	8.22
Wilder x Campbell	1,820	9	.49
Wilder x Niagara	396	0	0
Wilder x Champion	864	4	.46
Wilder x Winchell	1,404	0	0
Campbell selfed	1,764	10	.56
Wilder x Delaware	2,088	210	10.05
Wilder x Concord	2,816	230	8.16
Vergennes x Concord	720	42	5.83
Niagara selfed	600	8	1.33
Total crossed seeds	40,595	4,431	10.91

Cross	Seeds planted	No. Germ.	% of Germ.
Seedlings.			
	Seeds		
Niagara Seedlings	35,422	584	1.65
Wilder "	2,244	410	18.27
Salem "	744	95	12.76
Massasoit "	2,160	209	9.67
Delaware "	288	2	.69
Lindley "	21,336	4,471	20.95
Worden "	14,860	0	0
Champion "	18,216	736	4.04
Herbert "	10,164	1,959	19.27
Campbell "	23,804	797	3.34
Agawam "	16,608	632	3.80
Concord "	29,580	476	1.60
Vitis labrusca seedlings	120	8	6.66
Vitis riparia "	840	264	31.42
Total	176,386	10,643	6.03

	Total planted.	Total Germ.	% of Germ.
Seedlings—Open fertilized	176,386	10,643	6.03
Seedlings—Hand pollinated	40,595	4,431	10.91
Grand Total	216,981	15,074	6.94



Grape flowers showing the different methods of shedding the calyx.

Observations on the vigor and germination of the seeds show that the varieties which possess a portion of Vitis vinifera heritage give the highest germination and the most vigorous plants, while the varieties that are pure Vitis labrusca give a very low percentage of germination. Where the Massasoit appears either in an open fertilized seedling or cross-bred seed, the vigor is distinctly higher than in any of the others. The Concord and Delaware gave very poor results and of the Worden, none grew whatever. In the crosses where the European varieties were used as pollen parents, the germination was distinctly below any of the other crosses.

The grape breeding of 1915 is quite largely outlined in the following table:—

Cross.	No. bun. emasculated.	No. bun. pollinated.	No. bun. gathered.	No. seeds planted.	Remarks.
Concord x Champion.....	25	2	0	.....	All the Concords and Niagaras
Concord x Campbell	12	2	0		were emasculated during a very
Concord x Muscat of Alexandria	12	1	0		cold period when the temperature went down to even 40 and
Concord x Gros Colman..	10	1	0		did not rise much above 50 dur-
Concord x Niagara	10	7	0		ing the day and no doubt the ex-
Concord x Wilder	40	2	0		posed pistils became chilled and
Concord x Lindley	20	2	0		died. It was so cold, in fact,
Cottage x Vergennes	10	1	0		that all growth in the grapes
Cottage x Catawba	10	1	0		ceased for several days. The
Niagara x Wilder	10	10	0		workers were wearing over-
Niagara x Herbert (1)...	10	9	1	5	coats and gloves doing this work
Niagara x Delaware.....	10	10	6	139	in June, and it was reported in
Niagara x Barry	10	6	0		Toronto as the coldest period in
Niagara x Catawba.....	18	15	3	17	June for ten years.
Niagara x Agawam	10	9	8	233	(1) Small seeds.
Niagara x Vergennes	10	8	3	28	
Niagara x Concord	10	10	8	318	Crosses in which Concord pollen is
Niagara x Lindley	10	8	0		used may be crossed by Cottage
Niagara x Black Hamburg	10	8	8	63	as several of these vines are
Niagara x Muscat of Alexandria	5	3	3	16	mixed with Concord; however, the Cottage is a seedling of Con-
Niagara x Gros Colman..	5	3	0		cord and is very similar.
Niagara x Champion.....	11	11	6	63	
Niagara x Campbell	9	9	7	354	
Campbell's x Agawam...	20	15	7	36	
Campbell's x B. Hamburg	19	19	8	64	
Campbell's x Delaware ..	7	7	4	32	
Agawam x Concord.....	98	71	57	1388	See note opposite Niagara x Con-
Agawam x Niagara	96	96	59	1293	cord.
Agawam x Lindley.....	10	9	0		
Agawam x Champion....	6	6	0		
Agawam x B. Hamburg .	11	11	0		
Agawam x Vergennes ...	11	8	0		
Agawam x Campbell	7	7	6	157	
Agawam x Wilder	14	14	1	2	
Agawam x Delaware	10	10	3	28	

All the fruit was taken from skins, placed in water for two or three weeks, then taken out and dried for about four weeks and planted.

Where no number appears in the column under "No. bunches emasculated" in the following table, it indicates that the blossoms were not emasculated, but that the pollen of the male parent was applied and of course mixed with that of the female parent. It also indicates that these varieties are considered self sterile.

Cross.	No. bun. emasculated.	No. bun. pollinated.	No. bun. gathered	No. seeds planted.	Remarks.
Lindley x Campbell		20	12	416	
Lindley x Moore's		20	7	127	
Lindley x Concord		20	13	512	See note opposite Niagara x Concord in last table.
Lindley x Champion		20	12	235	
Lindley x Delaware		20	6	103	
Lindley x Niagara		20	15	482	
Lindley x Worden		20	18	991	
Salem x Campbell		20			
Salem x Concord		20	6	174	See note opposite Niagara x Concord.
Salem x Champion		20	3	23	
Salem x Niagara		20	11	82	
Salem x Worden		20	12		
Wilder x Campbell		18	1	47	
Wilder x Concord		22	2	25	See note opposite Niagara x Concord.
Wilder x Champion		20	1	4	
Wilder x Delaware		15	3	38	
Wilder x Worden		20	3	46	
Wilder x Niagara		20	4	92	
Massasoit x Delaware		24	8		
Massasoit x Concord		20	10	91	See note opposite Niagara x Concord.
Massasoit x Niagara		20	14		
Massasoit x Worden		20	16		
Massasoit x Champion		19			
Vergennes x Campbell		20	19		The Vergennes is partially self-fertile, therefore these fruits may be crossed or selfed.
Vergennes x Champion		20	18		
Vergennes x Delaware		19	18		
Vergennes x Niagara		20	17		
Vergennes x Worden		20	19		
Vergennes x Concord		20	8		See note opposite Niagara x Concord.
Eclipse x Niagara		21			
Isabella x Concord	29	29	6	65	See note opposite Niagara x Concord.
Isabella x Niagara	8	2	2	8	
Catawba x Niagara	9	9	7	96	
Muscat of Alexandria x Catawba	1	1	1	11	No account was kept of number of bunches covered and gathered in the following selfed varieties, but an accompanying sheet gives the relative degree of self-fertility of each variety.
Banner selfed					
Worden selfed					
Caco selfed					
Charlton selfed				25	
Chasselas avec Royal selfed					
Colerain selfed				63	
Read Hybrid					
Winchell selfed				135	
Diana selfed					
Duchess selfed					
Early Ohio selfed					
Eaton selfed					
Elvira selfed					
Green's Early selfed					
Hartford selfed				118	
Herman Jaeger selfed					
Hicks selfed				128	
Iona selfed					
Isabella selfed				47	
King selfed					
Lutie selfed					
Manito selfed					
McPike selfed					
Niagara selfed					
Pense Malaga selfed				56	
Perkins selfed					
Pierce selfed					
Wilkins selfed					
Vergennes selfed			60		
Agawam selfed		17	13	250	
Campbell selfed		12	12		
Diamond selfed					
Concord selfed					

No record was kept of the number of bunches selfed and gathered—simply the weight of fruit.

Where the number of seeds planted appears, it indicated that these seeds were planted in pots in the fall of 1915 and that the others have been layered and will be recorded when planted in the spring.

The following is a table showing the degree of self fertility of most of the varieties in the Experimental vineyard:—

Variety.	No. bunches.	Aver. degree of fertility 1-10	Conditions of Stamens.
Aminia	3	0	Rec.
Agawam	10	3.9	Up.
Banner	8	8.25	Up.
Barry	5	0	Rec.
Worden	9	7.1	Up.
Brighton	7	.071	Rec.
Caco	9	7.3	Up.
Campbell	5	6	Up.
Champion	3	2	Up.
Charlton	4	.625	Rec.
Chasselas avec Royal	5	10	Up.
Chasselas Vibert	4	0	Rec.
Colerain	7	2.28	Up.
Concord	10	6.6	Up.
Delaware	10	8.2	Up.
Diamond	10	9.6	Up.
Read Hybrid	9	7.44	Up.
Salem	10	0	Rec.
Vergennes	12	5.8	Up.
Winchell	9	9	Up.
Diana	10	8.1	Up.
Duchess	7	8.57	Up.
Early Ohio	10	7.7	Up.
Eaton	4	4	Up.
Eclipse	10	0	Rec.
Elvira	8	9.1	Up.
Green Early	9	9	Up.
Hartford	3	7.6	Up.
Herbert	10	0	Rec.
Hermon Jaeger	4	5.5	Up.
Hayes	8	0	Rec.
Hicks	13	3.1	Up.
Iona	7	7.85	Up.
Isabella	5	1.4	Up.
King	8	6	Up.
Rogers' 24	10	0	Rec.
Moore Eariy	2	5.5	Up.
Wilder	10	0	Rec.
King Philip	5	0	Rec.
Lindley	10	0	Rec.
Lucile	2	6.5	Up.
Lutie	9	7.88	Up.
Manito	8	4.87	Up.
Mary	7	0	Rec.
Massasoit	10	0	Rec.
Marrimac	7	7	Up.
Moore Early	10	5.7	Up.
Moyer	9	0	Rec.
McPike	9	6.8	Up.
Niagara	20	6.25	Up.
Pense Malaga	3	10	Up.
Perkins	10	7.6	Up.
Pierce	6	5.16	Up.
Pocklington	8	7.75	Up.
Rogers' 36	7	0	Rec.
Wilkins	7	5.7	Up.

The Method of Pollinating.

The blooming period of the grape flowers began on the 16th of June when flowers of the Pierce variety opened, but it was not until the 19th that the other varieties had generally begun to bloom. Flower bunches of the self-sterile and partially self-fertile varieties were enclosed in one-half pound paper bags on the 18th and 19th of June. Any flowers which were open at this time were picked from the bunches with a pair of tweezers before the bunches were enclosed in the bags. Following this the flower clusters of those self-fertile varieties to be used as pollenizers were enclosed in paper bags. The same precautions regarding flowers which were open were observed here as with the self-sterile varieties. By enclosing the flower clusters in this manner it was possible to prevent any cross fertilization of the grape flowers, other than the cross desired for the pollinating tests.

There was a wide variation in the time at which the flowers of the different varieties opened into full bloom. The Champion was the first to reach this stage on June 29th, and from then until July 7th, when the Delaware flowers were in full bloom, there was a slow succession of the other varieties. Because of this wide variation in blooming periods it was difficult to get the flowers of the different varieties in the proper condition, at the same time, to cross pollinate. For example, the Champion was in full bloom on June 29th, but it was not until July 3rd and 4th that the Vergennes and Wilder, respectively, had reached that stage. However, the work was done so far as the weather permitted when the pistils of the self-sterile varieties were most receptive. The operation of pollinating was done as follows: flower bunches for pollen were cut from their vines, shortly before they were to be used, while still enclosed in paper bags, and carried to the vine where the pollinating was to be done. Here the bag was removed from one of the flower clusters to be pollinated, and after it had been taken from the bag which enclosed it, one of the bunches of self-fertile flowers was dusted gently over it. Then this bunch of self-fertile bloom was placed beside the bunch pollinated and both were enclosed in the paper bag which had held the bunch of flowers for pollen. This operation was done quickly to reduce to a minimum the possibility of foreign pollen entering. In some cases where the anthers of the flowers used as pollenizers had already shed most of their pollen two and even three or four bunches were dusted over the bunch of self-sterile flowers to ensure pollination.

The following germination test has been outlined this fall to find the best method of handling grape seeds. Lindley, Concord and Massasoit varieties of seeds were used:

Experiment 1.—One hundred seeds of each variety planted immediately, but skin removed from the pulp and seeds.

Experiment 2.—One hundred seeds of each variety extracted from the pulp in water and layered in sand immediately.

Experiment 3.—One hundred seeds of each variety extracted from the pulp in water, dried for a month and then layered in sand.

Experiment 4.—One hundred seeds of each variety extracted from the pulp in water, dried, and planted one inch deep in the fall.

Experiment 5.—One hundred seeds of each variety extracted from the pulp in water, dried and kept dry until spring.

SMALL FRUITS.

Blackberries.

The work with blackberries was started in the spring of 1915 and consequently has not been carried very far. The following table sums up the work:

Cross	No. Poll.	No. fruit set	No. fruit gathered	Remarks
Wilson x Lucretia (Dewberry)	472	.....	168	Sept. 21 a number of small fruits not yet ripe and were not gathered.
Wilson selfed	10 sacks 109 buds	.....	54	
Wilson wind poll. test...	54 buds	18 druplets only set	Not picked	Emasculated and not covered. Each normal berry has from 60 to 100 druplets.
Wilson	5 sacks 54 buds	0	0	Emasculated but not pollinated.
Wild Blackberry selfed..	12 sacks 224 buds	.....	11	The berries maturing had very few druplets.
Wauchette Thornless at Tufford's, Jordan.	Open fertilized	.....	12	Open fertilized and plants all mixed in with Taylor.

Currants and Gooseberries.

With the exception of a number of seedlings grown from seeds of the leading commercial varieties, the work with currants and gooseberries has been developed only during the year 1915. The following table sums up the work:

Cross	No. Poll.	No. set	No. gathered
Eclipse (B. Currant) x Pearl (Am. Gooseberry).....	627	57	57
Pearl (Am. Gooseberry) x Eclipse (B. Currant)	120	0	
Fay's Prolific (R. Currant) x Broom Girl (Eng. Gooseberry)..	55	0	
Gooseberries:			
Red Jacket (Am.) x Whitesmith (Eng.).....	38	2	2
Red Jacket x Industry (Eng.).....	67	23	21
Red Jacket x Broom Girl (Eng.).....	27	4	0
Broom Girl x Pearl (Am.)	13	8	8
Pearl selfed	128	82	23
Whitesmith selfed	50	40	40
Industry selfed.....	50	48	17
Broom Girl selfed	12	6	0
Currants:			
Eclipse (Black) selfed	300	280	279
Fay (Red) selfed	90	90	86

From the 1914 open fertilized seeds the following are at present growing in the nursery rows:

Currants:

Perfection seedlings	22
Diploma seedlings	14
Cherry seedlings	10
Kerry seedlings	31
Collins Prolific seedlings	
Black Naples seedlings	100
Eclipse seedlings	11
Climax seedlings	232
Victoria seedlings	345
Lee Prolific seedlings	220
Saunders seedlings	151
Black Champion seedlings	238

Gooseberries:

Leader seedlings	1
Crown Bob seedlings	2
Whitesmith seedlings	1
Keen's seedling	2
Josselyn seedlings	6
Ironmonger seedlings	6

Also a large number of open fertilized seeds of the 1915 crop were saved from the following varieties:

Gooseberries:
Champagne White.
Red Jacket.
Keepsake.
Houghton.
Hedgehogg.
Josselyn.
Downing.
Industry.
Pearl.

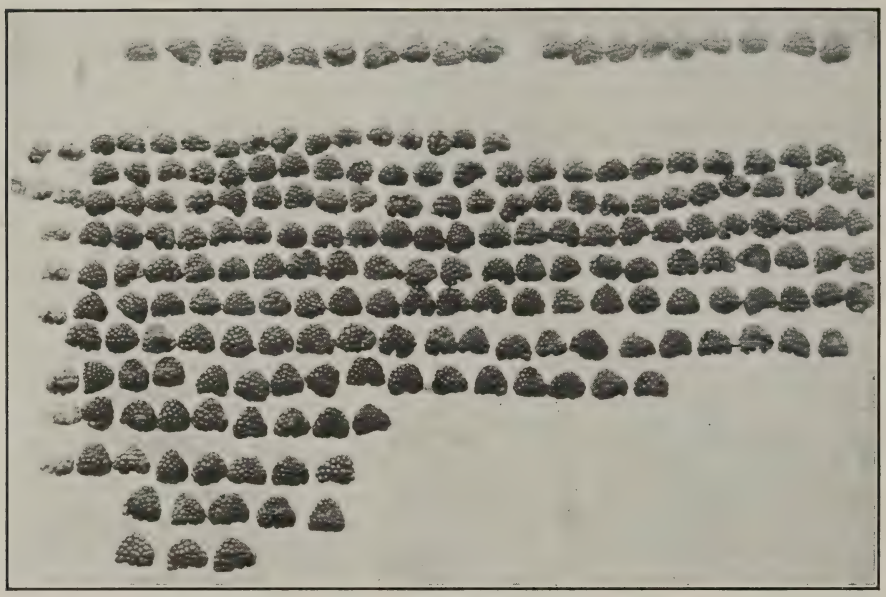
Currants:
Fay.
Red Cross.
Victoria.
Ruby Castle.
Diploma.
Perfection.
Pomona.
Prince Albert.
Lindley Market.
North Star.
Cherry.
Versailles.

Raspberries.

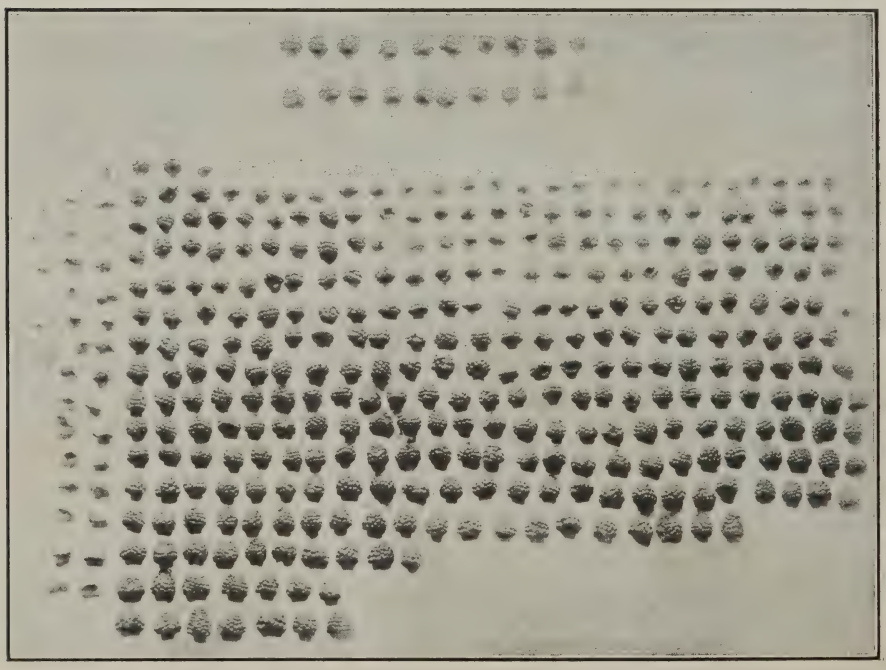
The raspberry breeding was started in the spring of 1913. Crosses between Cuthbert, Herbert and Marlboro were made in all combinations, also each variety was self-fertilized. These three varieties possess, when taken together, all the essential qualities of a first-class plant and berry, but each variety considered alone shows certain weaknesses. The seeds of these crosses were dried in sand and in the fall placed out of doors. In very early spring they were brought into the greenhouse where they started to grow.

Herbert on the right, Cuthbert in the centre and Marlboro on the left, showing the three types of raspberry.

Three thousand five hundred plants from these crosses were set in the field in the spring of 1914. Only 1,800 reached maturity. These fruited in the summer of 1915 and notes were taken on the quality, color, form, size, cavity, size of druplets, firmness, vigor of plant, and color of foliage of each plant. These notes are being retained for future reference and analysis in an endeavor to discover scientific data for future guidance in breeding.



Herbert and Cuthbert cross, Cuthbert at the right, Herbert at the left at the top. Each berry shown is from a different seedling plant. The berries are arranged in rows according to size.



Marlboro by Cuthbert. Cuthbert on top row and Marlboro on second row. Each berry shown is from a different seedling plant. The berries are arranged in rows according to size.

A number of plants were found with fruit of good size and quality and very productive. Thirty-three selections were made and transferred to a plantation for comparison with each other and with commercial varieties.

Seeds from the breeding work of the spring of 1914 were treated similarly and plants of the following list have been transferred to the field, but have not yet fruited:

Cuthbert x Herbert	86	Gregg seedlings	186
Herbert x Cuthbert	504	Wild Black Raspberry seedlings (R. occidentalis)—only part retained	1,306
Cuthbert x Marlboro	448		
Marlboro x Cuthbert	1,456		
Cuthbert selfed	205	Cuthbert selected from early bearing plant (seedlings)	196
Herbert selfed	403		
Marlboro selfed	280		

Work similar to the above was repeated this season, 1915.

Cross	No. Poll.	No. fruit set.	No. fruits gathered	Remarks
Gregg x Cuthbert	145	.....	38	
Cuthbert x Gregg	351	.....	10	
Cuthbert x Marlboro	331	.....	98	
Cuthbert x Herbert	234	.....	48	
Cuthbert selfed	12 sacks 178 buds	.....	120	
Cuthbert Parthenogenesis	5 sacks 51 buds	0	0	
Cuthbert wind poll. test	55 buds	14	not picked	These were emasculated and not covered.
Herbert x Cuthbert	459	.....	83	
Herbert selfed	12 sacks 156 buds	.....	71	
Herbert	6 sacks 50 buds	0	0	Emasculated but not pollinated.
Herbert wind poll. test	70 buds	17	not picked	These were emasculated and not covered.
Gregg	7 sacks 49 buds	0	0	Emasculated but not pollinated.
Gregg wind poll. test	50	4	not picked	These were emasculated and not covered.
Gregg selfed	12 sacks 115 buds	.....	64	Low number set largely due to aphides in sack.
Wild Black x Wild Red Rasp.	313	.....	84	
Wild Black selfed	10 sacks 108 buds	.....	56	
Wild Black Parthenogenesis	10 sacks 67 buds	0	0	
Wild Red x Wild Black Rasp.	910	.....	54	No fully developed fruit set. From 1 to 6 druplets in each fruit.
Wild Red selfed	532	1	0	The one which set was very small and only partly developed.
Wild Red Parthenogenesis.	10 sacks 84 buds	0	0	
Columbian selfed	11 sacks 171 buds	.....	112	A number of berries had only a few druplets formed.
Columbian Parthenogenesis	5 sacks 50 buds	0	0	
Columbian for wind pollination.	53 buds	0	0	Emasculated and not covered.

A large part of this work was done on the farms of Mr. Abner Honsberger and Mr. Joseph Brand, of Jordan, to whom we are much indebted.

The seeds from the above fruits have been layered for winter storage.

Strawberries.

The initial work in plant breeding was undertaken by Mr. A. J. Logsdail, now of the Central Experimental Farm, Ottawa. On the appointment of Mr. F. S. Reeves in 1912, the work was immediately continued and forty-four selections were made from the plot of about 3,000 seedlings left at the farm by Mr. Logsdail. The following year ten of the forty-four selected seedlings were retained for further trial. Of these ten only two, Nos. 37 and 40, are still retained.

Six thousand seedling strawberries fruiting, 1915.

The following table will give the quality and quantity of each lot for 1913 and 1914 where each plot consisted of nine plants originally set in the fall of 1912. In 1915 each lot was a matted row of sixty feet; consequently the yields for each year may not be compared with the other years, but the yields of each variety compared with the other yields of the same year.

No.	Quality	Plot of 9 plants each		Plot of matted row 60 feet long, 1915
		1913	1914	
7	Fruit of medium size, high quality and good color, very poor runner maker	25¼ ozs.	27¼ ozs.	3.5 lbs.
16	Fruit of medium size, high quality and good color, 1914 fruit was small	52 "	69¼ "	22 "
20	Very healthy, vigorous plants, seems to run all to leaf, fruit fair, deep rooted	21½ "	24 "	6.3 "
21	Small high colored fruit, deep set seed, good quality	32 "	62¼ "	9.0 "
23	Medium to large berry, very prolific (1913) deep set seeds. good color and quality, medium firm	46 "	11⅜ "	23.2 "
30	Large fruit, very prolific (1913) firm, somewhat light colored, good quality, early round berry	49½ "	22⅛ "	37.4 "
37	Good quality, dark berry, rather prominent seeds	46½ "	30½ "	33.3 "
40	Good quality, firm, medium size, medium color, seeds on the surface	49¼ "	56 "	27.5 "
41	Very high quality, cordate-shaped berry, comparatively few inconspicuous seeds	26¼ "	50¾ "	27.5 "
43	Good quality, seeds on surface somewhat soft	26 "	42 "	24.4 "

During the spring of 1913 more crosses were made and a number of varieties self-fertilized. The seeds from these pollinations after ripening were dried in sand for a week or more and then sown in flats. On September 15th the work of pricking out to fifty plants per flat was begun. The seedlings remained in the flats over winter, but when they had attained a fair size were placed in cold frames and covered with leaves. The following are the crosses made that year:

Early Ozark x Williams	200	Pocomoke x Michael	300
" x Brandywine	20	" x Senator Dunlap	450
" x Senator Dunlap	50	Sample x Williams	200
" x Michael	100	" x Early Ozark	216
" x Pocomoke	2	" x Brandywine	200
Williams x Senator Dunlap	350	" x Senator Dunlap	400
" x Pocomoke	200	" x Michael	100
" x Brandywine	700	" x Pocomoke	150
" x Michael	109	Michael x Williams	200
" x Early Ozark	300	" x Brandwine	345
Brandywine x Michael	350	" x Early Ozark	3
" x Pocomoke	750	" x Senator Dunlap	250
" x Senator Dunlap	45	" x Pocomoke	100
" x Early Ozark	100	Senator Dunlap x Williams	157
" x Williams	385	" x Brandywine	200
Bubach x Early Ozark	300	" x Early Ozark	500
" x Michael	50	" x Pocomoke	20
" x Brandywine	250	St. Louis Prize x Williams	300
" x Senator Dunlap	250	" x Brandywine	12
" x Pocomoke	32	" x Early Ozark	200
Pocomoke x Early Ozark	350	" x Joe	150
" x Brandywine	125	Joe x St. Louis Prize	100
" x Williams	100		

Self-fertilized Plants.

Chesapeake selfed	200	Oren, selfed	50
Uncle Jim selfed	100	Hundred Dollar selfed	30
Dornan selfed	12	Thomp. Seedling selfed	70
Stevens Late Champion selfed	144	Early Ozark selfed	80
Bederwood selfed	12	Williams selfed	450
Buster selfed	20	Brandywine selfed	30
Enhance selfed	250	Pocomoke selfed	200
Wm. Belt selfed	27	Michael selfed	30
Island King selfed	75	Senator Dunlap selfed	16
Fendall selfed	300	Ruby selfed	4
Clyde selfed	150	St. Louis Prize selfed	12
Woolverton selfed	25	Joe selfed	100
Glen Mary selfed	50	Nettie x Williams	308

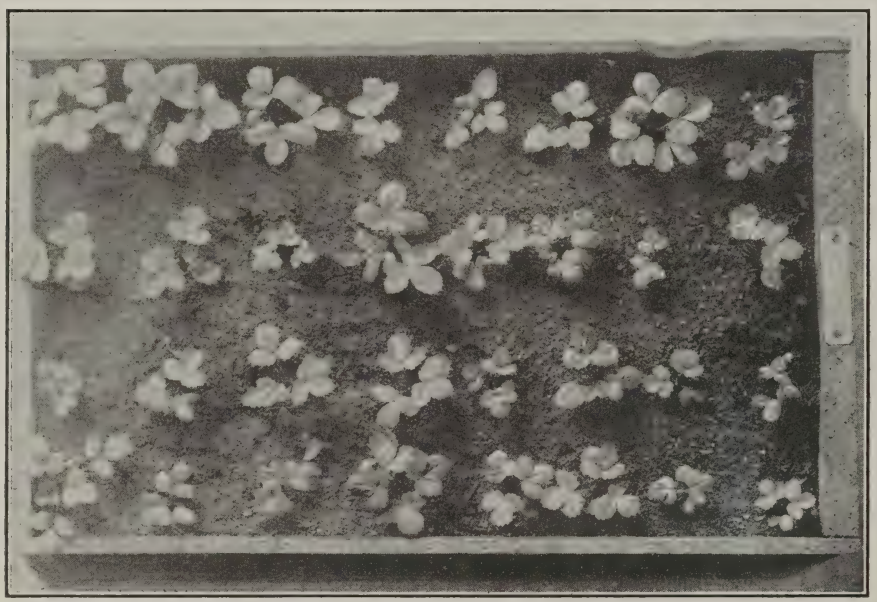
With the opening of spring the seedlings mentioned above were taken from flats and set in the open field. Of approximately 7,600 plants set out 6,300 lived to maturity. These fruited in the summer of 1915. Careful notes were made on individual plants under the following heads:

FRUIT—
Quality:
Color:
Exterior.
Interior.
Shape:
Size:
Calyx:
Core:
Seeds:
Number.
Prominence.
Color.
Productiveness:

Notes were also carefully made on sex, season of ripening and the number of runners produced. These and other observations made are being held with the object of accumulating data that may be of use in scientific deductions at some later date and for guidance in subsequent work.

In this plantation a large number of plants produced fruit of good quality, good size and in large quantity, but only one or two were noted to be outstanding in size and production.

There is a general apparent increase of vigor throughout the whole plantation, with the exception of a few individual plants. In the latter case, the poor showing is thought to be due to an outbreak of " white grubs " which weakened or destroyed many of the plants shortly after transplanting, and to a small portion of the plantation being a little lower and consequently wetter than the rest of the plantation.



Seedling strawberries in the "flat." These have been transplanted and are now ready for the field.

Two hundred and seventy-nine selections of these plants that show characters that are considered worth while have been selected and transplanted to another part of the farm for further trial. Here they are to be compared with each other and with the standard commercial varieties.

The seeds of the 1914 hybrids were treated similarly and the plants set in the field to be grown in the hill system. The following is a list of the plants set out:

Parson Beauty x Early Ozark	49
" x Michael	86
" x Brandywine	290
" x Williams	46
" selfed	16
Williams x Parson Beauty	223
" x Early Ozark	147
" x Michael	109
" x Brandywine	60
" selfed	107
Brandywine x Williams	7
Brandywine x Michael	94
" x Early Ozark	6
" x Parson Beauty	15
Early Ozark x Williams	145
" x Brandywine	3
" x Michael	10
Michael x Williams	76
" x Early Ozark	38
Brandywine selfed	8
Early Ozark selfed	13
Michael selfed	45

Cross pollination was continued in the spring of 1915 as indicated in the following table:

COMMERCIAL CROSSES

Cross	No. Poll.	Fruits set	Fruits gathered	Planted
Williams x Brandywine	1,415	519	389	July 19
Williams x Joe	373	123	95	"
Joe x Williams	183	108	90	"
Williams selfed	.....	.....	109	"

The method of covering strawberries to keep out foreign pollen.

Seeds of the F_2 generation of the Williams x Brandywine cross, and Brandywine selfed and Williams selfed, were secured, that is, plants of the F_1 generation of these varieties were selfed. A small number of the F_1 generation plants only was selected for this work because of limited time and space.

The seeds from the above were at once planted indoors and the plants will be put into the field in the spring of 1916.

VIABILITY OF POLLEN TESTS.

The experiments mentioned under this head are of value only to the plant breeder. They were carried out only to determine the accuracy of certain methods of work. The following plants were emasculated to test how much the wind aids in cross pollination. The pistillate varieties had the petals removed so that the insects would not be attracted, otherwise left ordinarily exposed:

Variety	No. of Blooms emasculated	Results
Highland Beauty	56	25 perfect fruit; 31 deformed fruit.
Crescent	72	50 " " 20 " " 2 not set.
Pocomoke	44	22 " " 15 " " 7 "
Glen Mary	33	14 " " 14 " " 5 "
Clyde	43	31 " " 8 " " 4 "
Warfield	26	16 " " 7 " " 3 "
Cobalt	49	19 " " 23 " " 7 "

Of 323 blossoms emasculated, 177 set perfect fruit (54.76 per cent.); 118 set deformed fruit (36.53 per cent.) and 28 did not set fruit at all (8.66 per cent.).

In the test of the efficiency of cheesecloth covered boxes to exclude the pollen the following results were obtained:

Parson Beauty: Fifty blossoms emasculated; set no well formed fruits. The deformed fruits set seventy-five seeds in all.

Wm. Belt: Sixteen blossoms emasculated; set only one fruit which was lying on the ground.

Dornan: Ten blossoms emasculated but no fruits or seeds developed.

Apparently from the above tests the cheesecloth covered box is efficient for the exclusion of pollen for practical breeding purposes, but it will not do for scientific purposes. When boxes with a very heavy cotton covering were used no fruit set. In this experiment about 100 blooms of Sample were used and 106 emasculated blooms of Pocomoke. In the latter variety, one fruit set near the ground, which might easily have been pollinated by some insect gaining access under the box.

The following is a list of the 1914 crosses:

Cross	Estimated % of fruit set after all pollination was done	No. fruits gathered
Parson Beauty x Michael	50	30
Parson Beauty x Early Ozark	50	17
Parson Beauty x Brandywine	50	21
Parson Beauty x Williams	40	18
Parson Beauty x Self	40	8
Williams x Brandywine	100	28
Williams x Michael	90	16
Williams x Early Ozark	90	19
Williams x Parson Beauty	85	36
Williams x Self	.....	14
Michael x Brandywine	25	11
Michael x Williams	25	6
Michael x Early Ozark	40	19
Michael x Parson Beauty	20	0
Michael x Self	.....	9
Early Ozark x Michael	50	8
Early Ozark x Williams	80	17
Early Ozark x Brandywine	70	7
Early Ozark x Parson Beauty	60	0
Early Ozark x Self	.....	10
Brandywine x Early Ozark	90	6
Brandywine x Michael	90	0
Brandywine x Williams	60	6
Brandywine x Parson Beauty	90	8
Brandywine x Self	.....	3

The low percentage of fruit set under boxes was largely attributable to the unnatural conditions. The plants and air remained damp for some length of time after a rain or a heavy dew. Very often fruits covered in this way fail to mature properly.

The 1915 tests for viability of pollen gave the following results:

Cross	No. Poll.	Fruits Set	Fruits Gathered	Planted	Germ.	Remarks
Michael x Parson 1912	77	0				
Michael x Parson 1913	34	0				
Michael x Parson 1914	71	0				
Williams x Parson 1913	40	2	2	July 19	0	These were small fruits having few seeds.

The efficiency of the box test gave the following results:

Michael	74	0				
Williams	56	1	0			Emasculated and not pollinated.

VEGETABLES.

Cucumbers.

An experiment to prove or disprove the empiric fact that the English long type of cucumber will set fruit and develop without fertilization, and that the White Spine type must be pollinated in order that they may develop normally was started in October, 1915. The crosses were made in an attempt to produce a White Spine type of cucumber that will set fruit without fertilization in commercial quantities the same as the English Long type does. A quantity of seed from the first cross has been secured.

Tomatoes.

The first season's results of an experiment in comparative yields of cross bred tomatoes with seeds obtained from open fertilized fruit was made in 1915. In making comparative notes of these crosses it was noticed that they vary a great deal, and even in the pure strains there are many different types, thus making it difficult to make accurate comparisons of types of fruit.

Crossing for the second year's work for seed on this experiment was carried on this season. Owing to much inclemency of weather at the time of pollination it was difficult to get sufficient fruits to set and from some of the crosses no fruit was obtained. However, plants have been secured in the greenhouse from the same seed as the field plants were grown from and will be crossed within the greenhouse during the winter.

The following table which follows gives the exact results and the total yield in bushels per acre:

Cross.	No. plants in plot.	Total good fruit in lbs.	Green fruit at last picking Sept. 28.	Total fruit in lbs.	Yield per acre in bushels.	Remarks.
Bruce's x Royal Red	20	288¾	13	301¾	856⅔	Acre yields taken on yield of good fruit.
Bruce's x Chalk's	20	267¾	2	269¾	795	
Bruce's x Earliana	20	292¼	½	292¾	866¼	Each plot occupied $\frac{1}{178}$ acre.
Bruce's x Ponderosa	20	249¾	2	251¾	741⅔	
Bruce's x Livingstone	20	234½	7	241¼	697½	791.4 average of F_1's
Bruce's x self	20	296¾	¾	300½	881	
Chalk's x Royal Red	20	247¾	20	267¾	735⅔	
Chalk's x Earliana	20	161¾	7½	169¼	480½	
Chalk's x Ponderosa	20	239¼	½	239¾	709	
Chalk's x Bruce's	20	208¾	4¾	213½	620	
Chalk's x Livingstone	20	301¼	18½	319¾	893	687.6 average of F_1's
Chalk's x self	20	260¼	8¾	269	771¼	
Earliana x Chalk's	20	275¼	¾	276	782	
Earliana x Livingstone	20	246¾	1	247¾	732⅔	
Earliana x Ponderosa	20	245¼	½	245¾	727	
Earliana x Bruce's	20	207	7½	214½	614	
Earliana x Royal Red	20	174½	8⅓	183	519	715.1 average of F_1's
Earliana x self	20	321¾	0	321¾	955	
Royal Red x Earliana	20	304	21⅓	325½	902	
Royal Red x Ponderosa	20	259¼	18	277¼	768¼	
Royal Red x Chalk's	20	237½	5⅓	243	706	
Royal Red x Livingstone	20	200	17½	217½	593⅛	
Royal Red x Bruce's	20	357	18½	375½	1,059	815.7 average F_1's
Royal Red x self	20	233¼	30¼	263½	691	
Livingstone x Ponderosa	20	313¼	9	322¼	928	
Livingstone x Bruce's	20	237¾	½	238¼	706	
Livingstone x Chalk's	20	206½	1½	208	611	
Livingstone x Royal Red	20	232½	32	264½	691	
Livingstone x Earliana	20	290¼	½	290¾	860⅛	759.3 average F_1's
Livingstone x self	20	136½	17½	154	406⅔	
Ponderosa x Chalk's,	20	290¼	¾	291	860⅛	
Ponderosa x Livingstone	19	273¾	14	287¾	854⅓	All brought up to the average for 20 plants.
Ponderosa x Bruce's	19	266½	18	284½	830⅔	" " " " " " "
Ponderosa x Earliana	20	117¼	¾	118	347	This row became very weedy owing to its being low and much water lying there during excessive wet spells.
Ponderosa x Royal Red	16	72	11	83	267	The row became very weedy. It was low and much water lay there during excessive wet spells.
Ponderosa x self	18	201	2½	203½	661½	

Tomato x Solanum balbisii, 1913:

Twenty plants of each of the F_2 generation of this cross, or supposedly this cross, were grown and careful observations made for any indication of them being true hybrids but none whatever were found. However, seeds from three fruits, two from one plant of lot 72 and one from lot 65 were saved, as they seemed to show a reduction of seeds in the individual fruits, although the other fruits on the same plant show a normal number of seeds. Seeds from ten other lots were saved also from which to grow the F_3 generation.

Tomato x Solanum balbisii, 1914:

From the ten fruits containing fully developed seeds last year the following numbers of plants were secured and transplanted to the field:

No. 1:24 A	5 plants	No. 19:5 A	8 plants
No. 4:4 A	1 plant	No. 19:7 A	13 "
No. 9:15 A	15 plants	No. 20:2 A	25 "
No. 4:17 A	16 "	No. 22:5 A	22 "
No. 16:22 A	59 "		

Notice the absence of seeds in the figure at the right. The long type of English Cucumber will develop without pollination. The cucumber on the left was pollinated by a variety of the white spine type.

Most of these plants grew to maturity and produced fruit but none of them showed any evidence whatever of being true hybrids. Owing to inclemency of weather at the time the sacks were applied for selfing the fruits no selfed fruit was obtained, therefore open fertilized fruit was gathered and retained for the F_2 generation. This cross was repeated in January, 1915, in the greenhouse with four other varieties of tomatoes with the following results:

Tomato x S. balbisii. January, 1915:

The pollen used was gathered out-of-doors before S. balbisii plants were killed by frost and retained for use on the tomatoes.

Cross	No. Poll.	No. Dev. to market-able size	No. Dev. to unmarket-able size	No. fruits in which no seed developed	No. fruits with fully developed seeds
Comet x S. balbisii	78	6	27	16	1
Sunrise x S. balbisii.....	68	10	28	16	8
Earliest of All x S. balbisii	49	2	6	1	7
Winter Beauty x S. balbisii	44	.....	1	.....	.....

The F_1 generation of these was composed of 172 plants and an observation of them in the field showed no indication of their being true hybrids, but tomatoes pure and simple. Seeds were saved from these from which to grow to F_2 generation.

Tomato x S. balbisii, 1915:

The cross was repeated again this year, when 1,528 pollinations were made on 50 plants, yielding 118 fruits of marketable size and 249 unmarketable. Of these ten contained developed seeds and the remainder no seeds whatever. The undeveloped seeds were not retained as experience proves they will not grow. Twenty-four per cent. of the fruit developed from this pollination, and it is evident that the tomato fruit will, to a certain extent, develop without being fertilized.

It is possible that we may find true hybrids in the F_3 generation and after that, if none are found, this whole experiment will be discarded.

S. balbisii x Tomato, 1913:

Thirty or forty plants of the F_2 generation from each of the F_1 generation plants were grown and carefully examined for evidence of any being true hybrids with tomatoes. None were found and the whole lot was discarded.

S. balbisii x Tomato, 1914:

From the eight fruits containing seed obtained last year the following number of plants were obtained:

No. 141	1 plant	No. 145	28 plants
No. 142	5 plants	No. 146	30 "
No. 143	7 "	No. 147	0 "
No. 144	3 "	No. 148	1 "

These plants were carefully examined for evidence of being hybrids, but none were found. But with the lot No. 144 two plants were distinctly S. balbisii and one tomato, and seeds from these three plants have been saved for the F_2 generation but the others have been discarded.

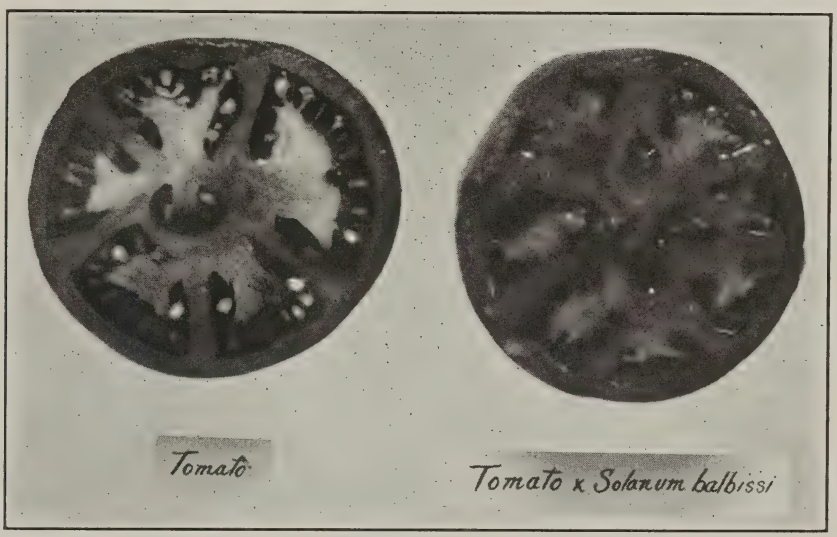
S. balbisii x Tomato, 1915:

One thousand five hundred blossoms of the S. balbisii were pollinated with tomato pollen, but no fruit set. A few fruits adhered and partially developed but failed to mature and contained no seeds. A parthenogenetic test was made and 1,500 blossoms were emasculated, but no fruit set. In 1904, from a parthenogenetic

test on S. balbisii three were found to contain seeds and three plants were obtained from one of these fruits, but they showed no evidence whatever of being anything but normal S. balbisii.

Grafts of S. balbisii on tomato and tomato on S. balbisii were made and it was found that the S. balbisii would grow quite readily and freely and develop into as large plants as the normal plants on tomato roots, but the tomato on S. balbisii roots were very difficult to set and then made a very short, poor, stunted growth.

A stimulation test was performed on tomatoes in which the following substances to substitute pollen were used: Apple pollen, $MgCO_3$, $CaCO_3$, Cement Dust and Sulphur. Between 25 and 36 pollinations were made with each and from these three fruits developed, all of which contained at least some developed seeds. The three obtained were: one from $MgCO_3$, one from Cement Dust and one from Sulphur.



Note the absence of seeds in the Tomato x *Solanum balbissi.*

Great care has always been exercised to emasculate the blossoms before they open or before there is danger of the anthers having burst, and the emasculated anthers are carried away and not allowed to lie around on the ground. Experience in this work seems to indicate that the tomato is capable of developing seeds without fertilization as well as developing as much as 24 per cent. of its fruit without fertilization. This latter conclusion is absolutely positive, as we have obtained normal and marketable size fruits with the seeds within remaining in the embryonic stage. The illustration shows this condition, in which one is a normal fruit with seeds, while the other has developed but the seeds have remained in the embryonic stage.

The interesting point to observe is, that although it is difficult to make out the presence and absence of seeds in each fruit, yet the fruit on the right is normal in size and quality but contains no seeds, while the one on the left is an ordinary tomato.

POMOLOGY

TREE FRUITS.

The Work with Apples.

1. The varieties in the following list are under test:

Adonis.
Alexander.
Arabka.
Arctic.
Arkansis.
Ascot (1916).
Astrachan.
Atlas (1916).
Baldwin.
Banana.
Banks Gravenstein.
Battle.
Baxter.
Ben Davis (1911).
Ben Hur.
Bethel.
Bismark.
Bjorkman.
Black Ben.
Blenheim.
Blue Pearmain.
Boiken.
Boskoop (1909).
Boyd Delight (1913).
Canada Red (1909).
Cayuga.
Champion.
Chenango (1909).
Claire.
Clive (1911).
Cora (1911).
Cornish Aromatic.
Cranberry.
Danville (1913).
Delicious.
Diana (1916).
Donald (1916).
Duchess (Oldenburg).
Dudley.
Fall Pippin.
Fameuse (1912).
Florence.
Forest (1911).
Gano.
Garden Royal.
Gen. Grant.
Glenton (1913).
Golden Russet (N.Y.).
Gravenstein (1909).
Greening.
Grimes.
Gypsy.
Haas.
Hibernal.
Holz (1916).
Hubbardston.
Hurlburt.
Hyslop.
Jeffries.
Jonathan.
Joyce (1916).
Keswick.
King.
King David.
Kildare (1916).
Kinn (1916).
Kitchener (1912).
Krupneena.
Langford Beauty (1911).
La Salle (1912).
Lobo (1913).
Louise (1911).
Lowell.
Lubsk Reinette (1911).
Magog.
Manda (1916).
Mann.
Marengo (1909).
Martha.
McMahon.
Medford (1911).
Melba (1913).
Mendel (1911).
Milwaukee (1910).
Minnesota.
Montreal Beauty.
Mother.
Muskoka Beauty.
Muskoka Champion.
Newton Pippin.
Niobe (1913).
North
N. W. Greening.
Ontario.
Opalescent.
Orange.
Ottawa (1911).
Peasgood.
Pedro (1916).
Peerless.
Percival (1911).
Petrel (1911).
Pewaukee.
Pinto (1913).
Powers.
Primate.
Radnor.
Ramona (1916).
Raynault.
Red June (1909).
Ribston.
Rocket (1916).
Rolfe.

Rome.
Rosalie (1913).
Rosenhagen.
Rufus.
Russell.
Rustler (1916).
Salome.
Scarlet.
Seek.
Shiawasse.
Siberian.
Sonora (1911).
Spy.
Stark (1916).
Stayman (1911).
St. Lawrence.
Sutton.
Thurso (1911).
Transcendent.
Van Wyck.
Vermac (1916).
Wagener.
Walbridge.
Wealthy.
Wellington.
Windsor.
Winterstein Pelham.
Wismer.
Wolf River.
Yankee.
Yellow Siberian.
Yellow Transparent.
York Imperial.

These varieties are used for general study, including fire blight susceptibility or resistance, a study of growing and fruiting habits, in a few cases for top working to seedlings and species of Pyrus, for cultivation, pruning, spraying and thinning tests, depending on the number of trees of the particular variety and the adaptability of the general situation for carrying on such experiments.

2. *Top-working.*

In the spring of 1908 the following varieties, four of each, were planted for top-working: Red Siberian, McMahon, Tolman Sweet, Hibernal, Baxter, Haas, Ben Davis, Duchess and Pewaukee. These varieties are on their own roots and were top-worked to Northern Spy in 1911. The tops have made good growth and in every case the union is strong. No crop has yet been harvested from them. These varieties are apparently more or less dwarfing when used as root and stock for the Northern Spy. The top, in a number of cases, already has outgrown its support.

3. *Low Headed vs. High Headed vs. Dwarf Trees.*

Six trees of each of the following varieties were planted in the spring of 1908 and headed high (4 feet), headed low (18 inches), and on Doucin roots and headed low: Astrachan, Duchess, Gravenstein, Alexander, Blenheim, Hubbardston, Cranberry, King, Greening, Baldwin, and Spy. The object in view was a demonstration of the extremes of heading and a test of dwarfing stock as an assistance to early bearing. No crop has yet been produced. This experiment has, in part, been neglected, but the trees are again resuming the habit that was formerly expected of them.

4. *Lime Sulphur vs. Soluble Sulphur for Scab Control.*

The orchard used in this experiment consists of 46 trees, 26 of which are sprayed in the usual manner with lime sulphur and 20 with soluble sulphur. The varieties are: Greening, Cranberry and Baldwin. The amount of scab is obtained by counting the blemished specimens and dividing by the total number of barrels of fruit. This gives the data in number of scabby apples per barrel of fruit picked.

In 1914, 52 1/6 barrels of apples from the trees sprayed with soluble sulphur had 1,551 apples with scab on them or an average of 29.7 scabby apples per barrel of fruit. The same year 97½ barrels of fruit from trees sprayed with lime sulphur gave 265 scabby apples, or an average of 2.7 scabby apples per barrel. An attempt

is being made also to measure the amount of foliage injury from the sprays. At no time has the injury been severe enough to be measured. Those trees, however, sprayed with lime sulphur may be said to have had a more thrifty appearance due to the color of the leaf. The work is being continued.

5. *Cultivation and Pruning.*

Six hundred and forty-six trees are devoted to this experiment. Of the total number 170 are planted as permanent trees and 476 as fillers. The permanent varieties are: Hyslop, McIntosh, Baldwin, Rhode Island Greening and Spy. The

Wagener, five years planted, summer pruned.

varieties used as fillers are: Wagener, Ontario, Wealthy, Duchess, and Dudley. There are 34 rows with 19 trees to each row. The rows are divided into 6 sections as follows:

Section 1—Rows 1 to 5.—This section is given clean cultivation until about August 1st and then plowed and left for winter. No manure is applied and no cover crop is used.

Section 2—Rows 6 to 11.—This section is carefully cultivated until June 15th when a cover crop is sown. It may be either spring or fall plowed. The plan is to continue sowing a cover crop early.

Section 3—Rows 12 to 17.—This section is carefully cultivated until July 15th when a cover crop is sown. The cover crop must be the same as that used in Section 2. The section is treated in every way the same as Section 2 except that the cover crop is sown one month later.

Section 4—Rows 18-23.—In this section a three year rotation is practised, grain crop seeded to clover, followed by the removal of a crop of hay, followed by a hoed crop. No cover crop is used and no manure is applied.

Section 5—Rows 24 to 29.—This section is treated the same as Section 4, except that farmyard manure is applied at the rate of twenty tons per acre immediately preceding the hoed crop.

Section 6—Rows 30 to 34.—This section has been seeded to a mixture of orchard and blue grass with a small quantity of White Dutch Clover. No crop is removed but the grass is cut at least twice each year and allowed to lie where it

Wealthy, Wagener, Duchess and Ontario. Five years planted, summer pruned, and unpruned showing a heavy bloom.

falls. The first cutting of grass in 1915 was spread close in around the trees to delay the development of a heavy sod.

In each section also is practised three different times of pruning: (*a*) winter pruning, (*b*) summer pruning, (*c*) little or no pruning.

Winter Pruning: These trees are severely cut back and thinned out in March or April. The object is to form a framework that is pleasing to the eye, and at the same time will carry a maximum load of fruit without damage when the tree comes into bearing. Fruit bearing is not to be taken into consideration for at least seven years.

Summer Pruning: In this case the trees are well thinned out in August and cut back only enough to keep the tree within bounds. The object is as much as possible to admit the maximum amount of sunlight and air, develop as many fruit buds and fruit spurs as possible, but at the same time not to sacrifice the shape of the tree any more than is necessary. The object is as early bearing as possible.

Unpruned Trees: Only a few cross and broken limbs are removed from these trees. They are left as much alone as is conveniently possible. The experiment is so planned that each variety is treated similarly and receives the same treatment under the various systems of cultivation. The object of the combined experiment is an experimental study of fruit bud formation in relation to cultivation and pruning. A careful record is made of the size and vigor of trees, number of fruit spurs and fruit set, quantity of fruit harvested, and comparative size, color and keeping quality. The trees were planted in the spring of 1911 and the cultivation experiment started immediately. The pruning part of the experiment was started in the spring of 1914.

Cherries.

The following varieties of cherries are under test:

Allen.
Baldwin (1909).
Belle de Franconville.
Belle d'Orleans.
Bessarabian (1915).
Bing (1915).
Black Bigarreau (1909).
Bohemian Black.
Brusseler Braune (1909).
California.
Chapman.
Climax (1912).
Compass (1912).
Double Natte.
Dyehouse.
Dykeman.
Early Lyon (1909).
Early Purple (1915).
Early Rivers (1909).
Elton (1915).
English Morello.
Eugenie (1909).
Florence (1909).
Fouche Morello.
Great Bigarreau (1909).
Hortense.
Ida.
Knight Early (1910).
Lambert.
Late Duke.
Leib.
Lewelling.
Louis Philippe.
Lutovka.
May Cluster (1915).
May Duke (1910).
Mercer.
Mezel (1913).
Montmorency.
Mount Stark (1909).
Murdock Bigarreau.
Napoleon.
Ohio Beauty.
Olivet (1909).
Ontario Preserving.
Ostheim (1913).
Paul.
Pelham.
Pickering.
Richmond.
Rockport.
Schmidt Bigarreau.
Spanish (1912).
Tartarian.
Terry.
Timmie (1913).
Vladimir (1915).
Weir (1909).
White Heart (1909).
Windsor.
Wood.
Wragg (1915).

Fall vs. Spring Planting.

The variety Windsor is used alone in this test. Twelve trees were planted in the fall of 1914 and twelve in the spring of 1915. Of the twelve fall planted trees six were pruned heavily and six thinned out and the top balanced only. Of the former five died and of the latter—unpruned except for thinning out—all are healthy. Of the spring planted all were pruned quite heavily by thinning out and cutting back at planting time. Six did not survive the summer and six are fairly thrifty. This work is being continued. The results so far point strongly to fall planting, and pruning only to thin out and shape the tree.

Peaches.

1. The following varieties of peaches, two of each, were planted in the spring of 1908:

Admiral Dewey.
Alton.
Arkansas Traveller.
Arp Beauty.
Arthur Chevreau.
Bailey.
Baltet.
Banner.
Barnard.
Baron Dufour.
Beer Smock.
Belle de Bordeaux.
Belle Henri Peinud.
Belle of Georgia.
Biquette Free.
Berenice.
Billmeyer.
Bilyer Late.
Bilyeu October (1915).
Bishop Early (1915).
Bokara (1915).
Bonanzo.
Bowslaugh Late.
Brackett (1915).
Brigdon.
Bronson.
Burke (1915).
Butler Late (1915).
Capt. Ede.
Cardinal (1909).
Cardindale.
Carman (1909).
Chair (1911).
Champion (1915).
Charles Ingouf (1909).
Chili.
Connett.
Cooledge (1915).
Crawford (Early and Late).
Crosby (1911).
Crothers.
Earliest of All (1909).
Early York.
Edgemont Beauty.
Edouard Andre (1909).
Elberta (Early and Late).
Engol Mammoth.
Exquisite.
Fitzgerald (1912).
Ford Late White (1915).
Fox (1915).
Galande.
Garfield (1912).
Geary Hold On (1915).
Gladstone (1909).
Globe.
Golden Drop (1912).
Goldfinch (1915).
Gold Mine (1909).
Goring Red.
Gov. Hogg.
Graves.
Greensboro.
Grosse Mignonne Hative.
Hale.
Hative Paullard.
Heiley.
Holderbouir.
Hooker.
Hynes (1911).
Illinois.
Iron Mountain (1915).
Jennie Worthien (1915).
Kalamazoo.
Keyport.
Klondyke.
Krummel October.
La France.
Lamont (1909).
Leamington.
Lee Angle.
Lemon Free.
Levy Late (1915).
Lewis.
Longhurst.
Lovell (1909).
Mamie Ross.
Marshall.
Matthews.
Mayflower.
May Lee Cling.
McCollister (1915).
McKay Late.
Michigan Beauty.
Millheiser.
Millionaire (1915).
Miss Lola.
Morris White (1912).
Mountain Rose.
Muir.
Munson Free.
New Prolific.
Niagara.
Oceania.
Oldmixon (1911).
Opoix.
Opulent.
Pearce Mammoth.
Pendleton.
Picquett.
Poole Favorite.
Prof. Villiare.
Prolific.
Pure Gold.
Purple Leaf (1915).
Ray.
Red River.
Reeves Favorite (1911).
Rex.
Richmond.
Rivers (1915).
Rouge de Maide Brigg.
Russell.
Salway (1910).
Sea Eagle.
Slappey.

Smithson.
Smith Superb.
Smock.
Sneed.
Snow.
Stephens.
Stinson.
Strawberry.
Stump.
Surpasse Melocoton.
Susquehanna.
Tennessee.
Tenton de Venus.
Thurber.
Townsend.
Triumph.
Victor.
Waddell.
Walkers.
Wallis Heath Free.
Washington (1911).
Weed Late Barnard.
Wellington.
Wheatland.
Wheeler.
Wilder.
Willet (1915).
Williams Favorite.
Worth.

Careful records are made of blossoming dates, fruit ripening dates, length of fruit season, yield per tree, keeping and shipping qualities of the fruit and any outstanding or peculiar characteristic of tree or fruit. An attempt is made also to record a complete and corrected description of each variety. Many trees are found not to be true to variety purchased. This is being corrected or noted where and when possible.

Root injured peach tree. Such trees usually come partly into leaf and possibly bloom and then die.

2. Fertilizers.

The peach fertilizer experiment has been carried on over a period of three years. Each plot is made up of twenty-four trees or approximately one-fifth of an acre. The various ingredients are purchased in the winter and as soon as growth starts or when the ground is in a fit state to cultivate they are mixed in the proper proportions and applied.

The orchard has been fall plowed regularly and the aim has been to cultivate immediately following the application of the fertilizer. Each year, except 1915, a cover crop has been used. In 1913 a good catch of crimson clover was obtained

and plowed under in the spring of 1914. In early July, 1914, oats were sown at the rate of one bushel per acre. These made a splendid growth in the fall but add little of nitrogen to the soil. There being no crop on the trees in this year the growth was exceptionally heavy and required some check. The 1915 cover crop was crowded out by extremely wet weather at the time it should have been sown.

The soil is a fairly heavy sand, several feet deep, under-drained and retentive of moisture. The only other fertilizer the orchard has had was a medium heavy mulching with farmyard manure in the fall of 1914.

1		2	
Nitrate of Soda	30 lbs.	Nitrate of Soda	30 lbs.
Muriate of Potash	40 "	Acid Phosphate	40 "
Acid Phosphate	40 "	Bone Meal	40 "
Bone Meal	40 "		

3		4	
Nitrate of Soda	30 lbs.	Muriate of Potash	40 lbs.
Muriate of Potash	40 "	Acid Phosphate	40 "
		Bone Meal	40 "

The fertilizer has been applied at the rate of:

Nitrate of Soda	150 lbs. per acre.
Muriate of Potash	200 " "
Acid Phosphate	200 " "
Bone Meal	200 " "

The trees are seven years of age.

RESULTS.

	Fertilized Average lbs. per Tree.		Check Average lbs. per Tree.	
	1913	1915	1913	1915
Plot 1	13.45	70.15	7.78	66.17
Plot 2	10.36	70.21	9.75	65.5
Plot 3	10.07	71.5	7.78	Some check trees
Plot 4	8.57	71.9	6.3	40.8 [lost

These figures speak for themselves.

The average of all the checks in 1915 is 57.47 lbs. per tree. The average of all the fertilized plots in the same year is 74.4 lbs. per tree, a difference in favor of the fertilized plot of approximately 17 lbs. or about a basket of fruit per tree. This is a result for one year only.

Nineteen hundred and thirteen gave a slight increase but the total crop was very small. In 1914 there was no crop.

3. Plum Roots for Peaches.

In the spring of 1908 a section of the Farm was selected which ordinarily would be considered too heavy for the profitable production of peaches. Twenty

rows of peaches, ten trees in a row, budded on plum stock (Prunus americana) were used in the test. The varieties used were: Yellow St. John, Capt. Ede, Niagara, Elberta, Greensboro, and Dewey. Side by side with these were planted the same varieties on peach stocks. The records do not show that the peaches on plum stock came into bearing any earlier than those on peach stocks. The trees were dwarfed, but not to any profitable advantage. When dug out the trees on plum stocks show a decided construction at the union of the bud as shown in the illustration.

Peach on plum root. Notice the constriction at point of union of root and trunk.

The suckering habit of the plum stock is a decided disadvantage. After the orchard is seeded with cover crop it has to be hoed to keep down the suckers.

The trees on plum stock were always apparently loose in the ground, showing that there was an insufficient root system. The difference in the crop yield was decidedly in favor of the trees on peach roots.

The above conclusion indicates that there is nothing to be gained by using Prunus americana as stock for peaches. It is just possible that some other plum stock might give more satisfactory results, and if an opportunity is presented others will be tried.

4. Other Tests.

Under the direction of Prof. Caesar of the Agricultural College, Guelph, some investigation work is under way regarding Little Peach and Yellows. Under the direction of Mr. W. A. McCubbin, Dominion Pathologist, St. Catharines, some work is also under way to determine if possible the cause and control of or remedy for Peach Canker.

Apricots.

The following varieties of apricots are under test:

Alexis (1911).
Harris (1911).
J. L. Budd (1911).
Montgamet (1913).
Shense (1911).
Stella (1911).

Thinned Apricot.

Unthinned Apricot.

Pears.

The following varieties were planted in 1908:

Admiral Gervais.
Albertine (1909).
Alencon.
Alexander III.
Amanlis.
Anjou.
Antoine Delfosse.
Bachelier.
Baltet Pere.
Bartlett.
Belle Renee.
Beurre de Naghin.
Boncretien.
Bordeaux (1909).
Bosc.
Boussock.
Capiaumont.
Catillac (1909).
Chaumontel.
Clairgeau (1913).
Clapp.
Clarksville.
Clavier.
Cole (1912).
Col. Marchand (1909).
Columbia.
Comice (1913).
Conference.
Crosby.
Danas Hovey.
Delaville.
Dempsey.
De Parennes (1909).
Des Moines.
D'Esperen.
Directeur Hardy.

Dorset (1912).
Dr. Joubert.
Drouard (1913).
Duchess.
Early Harvest (1912).
Easter Beurre.
Eva Baltet.
Fame (1909).
Fin Juillet.
Flemish.
Fondante d'Antoinne.
Fondante de Bois.
Forelle.
Fox.
Frederick Clapp.
Gans.
Gansel Bergamot.
Garber.
Gen. Stoessel (1909).
Geo. Boucher (1909).
Giffard.
Golden Russet.
Guyot (1909).
Heipt.
Heron (1909).
Hoosic.
Howell.
Jargonelle.
Jean d'Arc.
Josephine (1912).
Kieffer.
King Charles.
King Karl.
Koonce.
Lady Clapp.
Lamy.
Lawrence.
Le Clerc (Van Mons) 1909.
Lincoln Coreless.
Louise Bonne.
Louis Pasteur.
Lyerle.
Madame Tho. Levavassen.
Margaret.
Marguerite Marillat.
Marie Louise.
Mas (1909).
Mme. Earnest Baltet.
Notaire Lipin (1909).
Olivier.
Onandago (1909).
Ozark.
Passe Colmar (1909).
Pres. Casimir Perier.
Pres. Deviolaine.
Princess (1909).
Princess Copie (1910).
Prof. Grosdemange.
Rance.
Reeder (1912).
Reliance (1909).
Renfrew.
Riehls.
Ritson.
Roosevelt.
Seckel.
Sheldon.
Sir de Jules Guindon (1909).
Snyder.
Souvenir.
Souvenir du Pres. Carnot (1909).
Stark (1909).
Summer Doyenne.
Superfin.
Thirriot.
Tongres (Durondeau), (1909).
Totleben (1909).
Tyson.
Vermont Beauty.
Virginia Baltet.
Wilder Early.
Winter Bartlett.
Worden.

A large percentage of these varieties has been destroyed by blight. Attempts were made in 1914 and 1915 to control this disease by cutting out and disinfecting, but only with partial success. Careful notes were made of the susceptibility of the various varieties to blight, but in a great many cases the tree was lost completely.

But few varieties have yet fruited and no report is available on any of them.

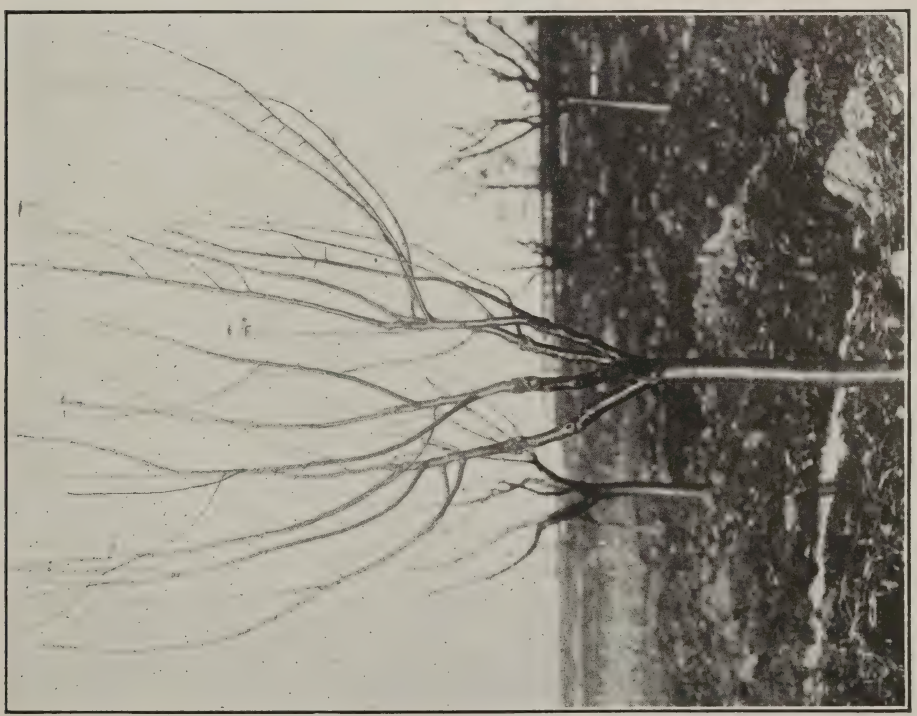
(2) An attempt was made when the orchard was set in 1909 to test side by side, Bartlett, Clapp, Duchess, Flemish, Anjou and Easter Beurre on Standard and Dwarf stock. As is the case with the varieties under test, blight has destroyed a large percentage of the trees. These have been filled in. The percentage of loss has been much less in the dwarf than in the standard trees.

Plums.

The following varieties of plums are under test:

Abundance.
America.
Ancaster.
Apple.
Arch Duke.
Arctic.
Bartlett.
Belgian Purple (1909).
Belle.
Belle de Louvain (1909).
Belle de Paris.
Bleeker.

Dwarf Bartlett, 7 years planted.



Kieffer top worked to Bartlett. Very subject to blight.

Blue Prolific.
Bradshaw.
Burbank.
Canada Orleans.
Chabot.
Climax.
Clyman.
Curlew (1909).
Daisy (1909).
Darwin Peach (Yellow Egg), (1909).
Denbigh (Cox's Emperor).
De Soto (1913).
Diamond.
Duane.
Earliest of All.
Early Prolific (Early Rivers).
Early Rivers.
Early Transparent.
Emerald.
Fellenberg.
Femmonzi.
Field.
Formosa.
French
Gaviota (1911).
German Damson.
German Prune.
Giant.
Gideon.
Gisborne.
Glass.
Golden Drop (Coe).
Golden Gage.
Goliath.
Grand Duke.
Guard.
Gueii.
Hand.
Hulings.
Hunt.
Imperial Gage.
Imperial Lombard.
Imperial Peach.
Improved Lombard.
John A.
Kahinta (1915).
Kelsey.
King Damson.
Kingston.
Klondyke.
Large Golden Prolific.
Latchford.
Lombard.
Lowry.
Lucy Gray.
Mallard.
Mary.
Mathews.
Maynard (1912).
McLaughlin.
Monarch.
Monroe.
Moyer.
Naples (1910).
Niagara (Bradshaw).
October.
Omaha (1909).
Quackenboss.
Raynes.
Red June.
Red Magnum Bonum (Red Egg).
Reine Claude.
Riley Damson.
Rockford.
Santa Rosa.
Sapa (1915).
Saratoga (1910).
Sargent (1909).
Satsuma.
Saunders.
Shipper.
Shropshire (1909).
Silver (1909).
Smith Orleans.
Splendor (1909).
Standard.
Stanton.
Stella.
Sugar.
Sultan (1909).
Sutton.
Tennant.
Thanksgiving.
Togo.
Tokata.
Uncle Ben.
Vesuvius.
Victoria.
Warner.
Washington.
Waugh.
Willard.
Wolf (1913).
World Beater (1909).
Wyedale (1909).
Yellow Egg.
York State Prune.

Fall vs. Spring Planting, vs. Dynamited Holes.

The variety Reine Claude has been used alone in these tests. The soil is a heavy red and blue clay with a very impervious subsoil. The last plantings were made in 1914 (fall) and 1915 (spring) and 1915 (fall) and 1916 (spring). The first plantings were made in 1911 and 1912, but at that time the experiment did not include spring planting in fall dynamited holes. Though the trees had not fruited the general size, health and vigor of the trees in the various plantings seemed to indicate that the trees set in holes immediately after dynamiting were for some cause weakened and delayed in growth. This was attributed to the rapid

drying out of the soil immediately following dynamiting, which delayed the starting of the trees. To overcome this apparent difficulty the experiment was continued, with the addition of trees planted in holes dynamited in the fall and allowed to fill with water and settle. No trees have yet borne any fruit.

The Work with Grapes.

The following is a list of the varieties in the Experimental vineyard. They are arranged alphabetically without regard to species, commercial value or adaptation to the district:

Adobe.
Agawam (Rogers' 15).
Amber Queen.
America.
Aminia (R. 39).
Armalaga.
August Giant.
Augustina.
Australis.
Bacchus.
Bailey.
Banner.
Barry (R. 43).
Bell.
Ben Hur.
Berckmans.
Black Morocco.
Brighton.
Caco.
Campbell.
Captivator.
Carman.
Carmen.
Catawba.
Champion.
Charlton.
Chasselas avec Royal.
Chasselas de Fontainebleau.
Chasselas Vibert.
Clinton.
Cloeta.
Colerain.
Concord.
Cornichon.
Cottage.
Creveling.
Cynthiana.
Dattier de Beyrouth.
Delaware.
Dog Ridge.
Diamond.
Diana.
Dracut Amber.
Duchess.
Early Daisy.
Early Ohio.
Early Victor.
Eaton.
Eclipse.
Ellen Scott.
Elvira.
Emperor.
Empire State.
Ester.
Etta.
Eumelan.
Feher Zagos.
Fern Munson.
Flame Tokay.
Gaertner (R. 14).
Geneva.
Golden Chasselas.
Golden Drop.
Golden Queen.
Green Early.
Hartford.
Hayes.
Headlight.
Herbemont.
Herbert (R. 44).
Hernito.
Hicks.
Iona.
Isabella.
Italian, Walker's.
Ives.
Jaeger.
Janesville.
Jessica.
King.
King Philip.
Lady Finger.
Lady Washington.
Last Rose.
Lincoln (Read's Hybrid).
Lindley (R. 9).
Lucile.
Lukfata.
Lutie.
Malaga.
Manito.
Martha.
Mary.
Massasoit (R. 3).
McPike.
Mericadel.
Merrimac (R. 19).
Mission.
Moore Early.
Morocco.
Moyer.
Muench.
Munson.
Muscat.
Muscat Blanc.
Niagara.
Nitodal.
Patricia.
Pense Malaga.
Perkins.

Phillippi.
Pierce.
Pocklington.
Prentiss.
President.
Reissling.
Requa (R. 28).
Rockwood.
Rogers 24.
Rogers 26.
Rogers 36.
Rommel.
Rose of Peru.
Sabal Kanski.
Salem (R. 22).
Sauvignon Juane.
Telegraph.
Thompson Seedless.
Ulster.
Vergennes.
White Cornichon.
Wilder (R. 4).
Wilkins.
Winchell (Green Mountain).
Woodruff.
Worden.
Wyoming.

Grafting Resistant Vines.

This study of stocks for Vinifera vines is being made with the hope that by making use of the variations which have arisen naturally between species of grapes, in grafting Vinifera varieties on hardier, phylloxera resistant stocks, it will enable us to produce commercially some of the choice varieties of this species (Vitis vinifera).

The investigation of this problem includes:

1. A study of the characteristics and adaptability to this district of the mother vines from which the stocks for grafting will be taken.

2. A study of the problems of grafting, namely, the making and conservation of cuttings, the preparation of the stocks, the time of grafting, the method of making the graft, callousing the graft, the grafting of rooted cuttings, the planting and treatment of grafts in the nursery, and the advisability of field grafting.

3. A study of the affinity of the scion to the stock, and the adaptability of both to the conditions existing in a commercial vineyard in Ontario. This will give definite information regarding the possibility of hastening or retarding the time of maturity of the grafted vines, their resistance to insect and fungus pests, their ability to stand the winters of this district, and the adaptability of the stocks used to the different soils of the Peninsula. In short, this last work is expected to determine whether the production of some varieties of Vinifera grapes will, or will not be a commercial success in the Niagara District.

In the summer of 1915 a very small beginning on the work outlined above was made. Wild vines, native to the district, and belonging to the following species have been located: Vitis riparia (male and female), Vitis bicolor (male), Vitis cineria (female), and Vitis labrusca (female). Cuttings will be taken from these vines this fall. From these cuttings mother vines will be produced to furnish stocks for grafting and also for purposes of study.

The methods followed in grafting, callousing, planting and cultivating resistant vines during the spring and summer of 1915 were as follows:

Cuttings to be used as stocks for grafting were taken March 29th from vines of the species Vitis rupestris, variety St. George and packed in sand in the cold storage until April 6th, the time of grafting. The cuttings used as scions were obtained partly from Prof. F. T. Bioletti, Viticulturist of the University of California, and from vines shipped here from Fresno, California. These vines arrived March 25th and were "heeled in" in moist sand in the cellar of the packing house.

The Rupestris St. George cuttings used for grafting stock averaged six inches long and one-quarter of an inch in diameter. When these cuttings were taken the lower cut was made through the knot of the bud, the last internode of the upper end was left as long as possible, as the internodes were scarcely long enough

for the grafting cut. All of the buds on the stock were carefully removed, not only the main bud, but also the small adventitious buds which usually surround its base. and which, if not cut, would produce sucker growths at the expense of the graft. These cuttings were then soaked in water about ten minutes to free them from any sand which might have stuck to them, and also to freshen and make them sappy before grafting.

The scions were prepared in a similar way with the exception that the buds were left. The scions were taken with two eyes, the upper cut was made about three-eighths of an inch above the second eye, while the lower cut was made from two inches to three inches below the first eye, thus leaving plenty of room for the grafting cut.

The raffia used for binding the grafts was soaked in water to make it easy to handle. Then it was cut in lengths nine inches long and kept moist and ready for use.

The grafting knife was not of the pattern generally used in Ontario, but was an ordinary jack-knife with an especially thin, sharp blade.

The English cleft or whip graft was used entirely. The stock and scion were chosen of as nearly equal diameter as possible and were cut at the same angle. The length of the cut surface varied from three to four times the diameter of the cuttings. The cut was made at an angle of nineteen degrees. The smaller the cutting the longer the cut was made. The tongues were made by a longitudinal cut, care being taken not to split the wood, usually commencing at about one-third the distance from the sharp end of the cutting; and were made to a depth about equal to the diameter of the cutting.

Raffia treated as already explained was used in binding the grafts. According to Prof. Bioletti, California No. 127, on "Bench Grafting Resistant Vines," "Grafts do better without any binding but for two reasons: first, because it is difficult to handle unbound grafts without disturbing the union; and, second, because the callous does not form simultaneously on all parts of the union, and the first formed tends to push apart the stock and scion, thus making it difficult or impossible for all parts to unite." Hence, as little raffia as possible with the thorough firmness of the union was used.

A hot bed used to grow early onion plants was partitioned off and one-third of it was used as a callousing bed. About six inches of fine, clean, dry lake sand was spread on the manure of the hot bed. The bundles of grafts were placed in a slightly inclined position, with the scions uppermost, in three rows across the bed. The sand was packed well around and sifted between the grafts. They were then covered to a depth of three inches with sand. The hot bed was covered with sash so that the moisture content of the sand and the temperature could be controlled. The temperature of the bed averaged 76 degrees F. The moisture content of the sand was varied to quite an extent. For the first two weeks of the callousing period the moisture content of the sand was about four times more than it should have been. No callousing took place during this time. Later when the moisture content of the sand had been reduced by evaporation to about 2 per cent. callousing took place rapidly. By the 27th of April the grafts were well cemented in most cases by a strong callous. The excess moisture and high temperature during the first days of the callousing period forced the scions to send out white shoots often one and one-half inches long. Roots had also started from the stocks, but were much longer than they should have been.

The grafts were set nine inches apart in a furrow. Care was taken in planting to keep the unions about one and one-half inches above the surface of the soil,

so that when the soil settled the unions would be level with the surface. To prevent the drying out of the union the soil was mounded up to the graft, and all excepting the top eye was covered.

The soil was moist and cool at the time of planting, but a series of short rains coming on at this time made the soil cold and wet.

The change from the hot bed to the nursery row was so great that the shoots which had started from the cuttings were killed. In most cases the scions tried to produce other shoots, but their store of plant food had been drained by the first attempt, and they failed to start again. Of the 24 grafts and 324 cuttings of different wild species set out in the nursery this spring not one has taken. Following is the planting list for the grafts and cuttings.

Planting done in the same row as the Vinifera varieties on Concord stock.

No. of Cuttings.	Varieties grafted on Rupestris St. George stock.	No. of Cuttings.	Varieties grafted on Rupestris St. George stock.
1	Feher Zagos.	2	Rose of Peru.
3	Italian—Walker's	2	Sabal Kanski.
1	White Cornichon.	2	Golden Chasselas.
1	Phillipi.	2	Emperor.
2	Malaga.	1	Muscat.
3	Flame Tokay.	1	Lady Finger.
1	Morocco.	2	Mission.

No.	Variety.	No.	Variety.
29	Labrusca—Isabella.	69	Rupestris Pillans.
49	Riparia-Grandes Feuilles.	36	Rupestris St. George.
16	Wild Vine No. 111.	20	Wild Vine No. 111.
37	Arizonica Phoenix.	27	Rupestris Mission.
27	Rupestris St. George.	14	Wild Vine No. 1.

VINIFERA VARIETIES ON CONCORD ROOTS.

Besides the few cuttings which were bench grafted, as already described, some 150 one and two-year-old Concord vines were grafted with scions taken from the vines obtained from the White Nursery Co., and also, from cuttings sent by Prof. Bioletti. The Concord vines arrived from the nursery on March 2nd and were "heeled in" in moist sand in the cold storage until April 8th, the date of grafting.

There was a wide variation in the size of the vines used as stocks and there was a greater variation in the size of the cuttings used as scions. The vines varied from ¼ inch to ½ inch in diameter just below the bud of the original cutting. The scions varied from 3/16 inch to ⅝ inch in diameter. As far as possible the grafting cut was made on the stock just below the bud of the original cutting; but when the scion was too small to fit properly on the stock at this point, the cut was made on the growth of the preceding year.

Immediately after grafting the vines were placed in a box and covered with a wet blanket. In this box they were carried to the vineyard where they were planted, April 10th. The space where these grafted vines had been planted was, however, needed for some other vines and on April 12th the grafted vines were removed and replanted two feet apart in rows four feet apart. While moving the grafts many of the scions were loosened and a few were lost, in which cases the vines were grafted again.

The roots of the Concord stocks were thinned and cut back to nine inches before planting. The same method of planting was followed here as in the case of the grafted cuttings.

On August 21st the mounds of earth around the grafts were removed, the scion roots cut, and the number of grafts which had taken noted.

The following list gives the number of grafts planted, the number which set, the number of scions which rooted without the graft setting, the number of stocks which grew instead of the scions and the number of stocks which died:

Variety.	No. of grafts made.	No. of grafts taken.	Scions.	Concord roots still good.	Spaces.	% of grafts set.
Phillipi	4	1	.....	2	1	25
Malaga	2	.....	.....	1	1	0
Golden Queen	1	.....	.....	1	.....	0
Dattier de Beyrouth	2	.....	.....	1	1	0
Golden Chasselas	7	.....	2	4	1	0
Emperor	4	.....	.....	2	2	0
Thompson Seedless	5	.....	.....	2	3	0
Rose of Peru	7	1	.....	1	5	14.2
Muscat	12	2	.....	7	3	16.6
Lady Finger	3	.....	.....	3	.....	0
Black Morocco	2	1	.....	.....	1	50
Morocco	2	1	.....	.....	1	50
Feher Zagos	3	.....	.....	.....	3	0
White Cornichon	2	.....	.....	1	1	0
Sabel Kanski	5	3	.....	2	.....	60
Flame Tokay	6	4	.....	1	1	44.4
Savignon Blanc	6	2	2	1	1	331/3
Droukal	6	1	1	1	3	14.4
Chasselas de Fontainebleau	4	3	1	.....	.....	75
Savignon Vert	4	2	2	1	.....	50
Walker's Italian	5	.....	1	3	1	25
Corinth Black	7	2	3	.....	2	28.5
Bakator	3	3	.....	.....	.....	100
Zabalkarsski	5	3	.....	.....	2	60
Mission	4	1	.....	2	1	25
Palmonina	5	3	2	.....	.....	60
Anadiska	6	2	2	1	1	331/3
Corinth White	3	2	1	.....	.....	662/3
Prince Black	7	3	3	1	1	42.8
Ruglienga	6	1	2	1	2	14.4

Relation Between Size and Weight of Grape Seed, and Germination and Vigor of Seedlings Produced.

Following are a set of tables showing the results at the end of one year of a test to ascertain the correlation between the size and weight:

Table 1.—Wilder x Delaware Seeds

Seeds			Germinations August 15			Vines at close of season	
Number	Average weight in Grammes	Grade in mm.	Number	Percentage	Ratio	Number	Dia. in mm. at collar
1	.0045	3	0	.....	.....	.....	0
5	.0113	3½ A	0	.....	.....	.....	0
8	.0135	3½ B	2	25.0	1:4	2	3.75 mm.
68	.0144	4 A	4	5.88	1:17	3	2.9 "
147	.04665	4 B	31	21.08	1:474	21	2.6 "
150	.0468	4½ A	23	15.33	1:65	13	2.79 "
451	.04935	4½ B	85	18.84	1:531	49	2.11 "
377	.049925	5 A	75	19.62	1:502	37	2.43 "
653	.052	5 B	125	19.14	1:514	65	2.62 "
12	.0505	5½ A	2	16.66	1:6	1	2.9 "
24	.0533	5½ B	9	37.5	1:266	6	2.31 "
1	.056	6	1	100	1:1	1	3.9 "
	Ave.			Ave.	Ave. Ratio		Ave. for Cross
1897	.037517	.....	356	28.90	1:606	198	2.83

Table 2.—Wilder x Concord Seeds

Seeds			Germinations August 15			Vines at close of season	
Number	Average weight in Grammes	Grade in mm.	Number	Percentage	Ratio	Number	Dia. in mm. at collar
2	.0075	3	0	.....	.....	.....	.....
11	.0128	3½ A	0	.....	.....	.....	.....
13	.0232	3½ B	2	15.38	1:65	1	3.0
289	.03835	4 A	25	8.65	1:11.56	18	2.8
462	.041325	4 B	115	24.89	1:4.01	80	2.29
334	.04305	4½ A	57	16.76	1:5.85	32	2.75
761	.04575	4½ B	144	18.92	1:5.28	79	2.31
173	.04785	5 A	31	17.74	1:5.58	22	2.55
637	.049275	5 B	168	26.40	1:3.79	112	2.66
13	.0512	5½ A	1	7.69	1:13	0	0
9	.0548	5½ B	1	11.11	1:9	1	3.0
1	.054	6	0	.....	.....	0	.....
	Ave.			Ave.	Ave. Ratio		Ave. for Cross
2705	.039091	.....	544	16.39	1:7.17	345	2.67

TABLE 3.—VERGENNES X CONCORD SEEDS

Seeds			Germinations Aug. 15			Vines at close of season	
Number	Average weight in Grammes	Grade in mm.	Number	Percentage	Ratio	Number	Diameter in mm. at collar
0	.....	3	0	.....	.....	.....	.....
0	.....	3½ A	0	.....	.....	.....	.....
2	.008	3½ B	0	.....	.....	.....	.....
42	.031275	4 A	5	11.90	1:8.4	0	0
41	.04025	4 B	13	31.70	1:3.15	1	2
95	.0425	4½ A	33	34.73	1:2.87	4	2.1
147	.04575	4½ B	45	30.61	1:3.26	10	1.74
217	.046375	5 A	71	32.71	1:3.05	25	1.99
151	.0503	5 B	42	27.81	1:3.59	12	1.7
13	.04965	5½ A	4	30.76	1:3.25	1	3.5
29	.050925	5½ B	7	25.51	1:4.14	3	2.33
3	.05	6 A	2	66.66	1:1.5	1	2.2
3	.05666	6 B	2	66.66	1:1.5	1	2.7
743	Ave. .042880	.....	224	Ave. 35.90	Ave. Ratio 1:3.47	58	Ave. for Cross 2.25

TABLE 4.—NIAGARA SELFED SEEDS.

Seeds			Germinations August 15			Vines at close of season	
Number	Average weight in Grammes	Grade in mm.	Number	Percentage	Ratio	Number	Diameter in mm. at collar
0	.....	3	.....	.....	.....	.....	.....
0	.....	3½ A	.....	.....	.....	.....	.....
1	.019	3½ B	0	.....	.....	.....	.....
17	.0235	4 A	0	.....	.....	.....	.....
32	.033	4 B	2	6.25	1:16	1	2.1
93	.0393	4¼ A	2	2.15	1:46.5	0	0
103	.043225	4½ B	4	3.88	1:25.75	3	4.03
203	.04475	5 A	7	3.44	1:29	2	2.25
96	.0505	5 B	7	7.29	1:13.7	1	2.5
23	.052	5½ A	1	4.34	1:23	0	0
23	.057725	5½ B	1	4.34	1:23	0	0
5	.051	6 A	0	.....	.....	.....	.....
5	.0572	6 B	0	.....	.....	.....	.....
601	Ave. .04836	.....	24	Ave. 4.52	Ave. Ratio 1:25.28	7	Ave. for Tot. 2.72

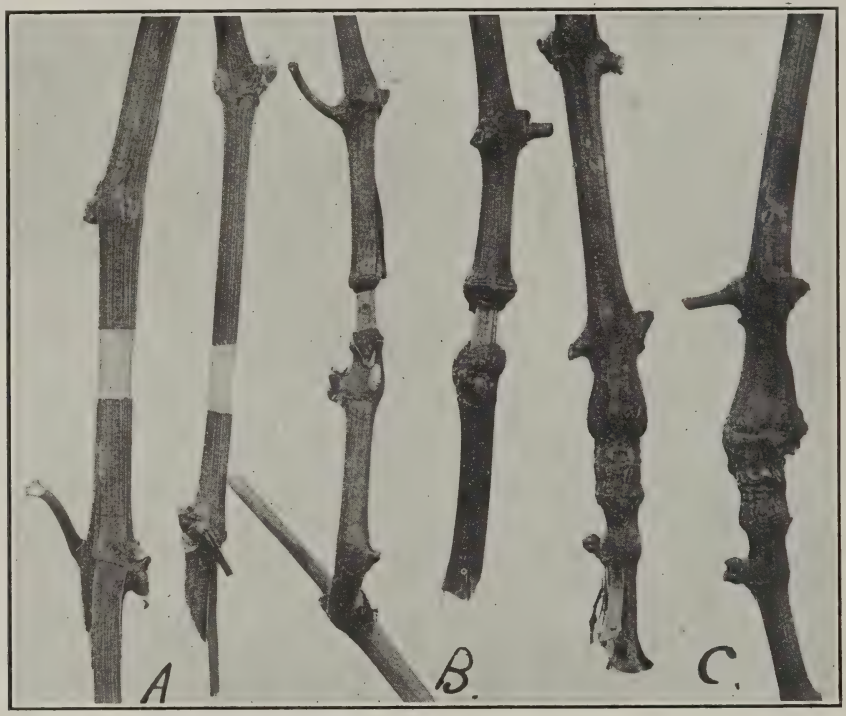
DISBUDDING VS. SUMMER PRUNING.

At this time it is impossible to give the results of this experiment in full because the crop has not been harvested.

Disbudding is the practice of rubbing off the young shoots when they are about eight inches long and before they begin to get woody. Summer pruning is a practice generally followed throughout the Niagara District, and consists of cutting superfluous canes during the middle of August to permit better air circulation and allow the sunlight to reach the grapes.

The object of this experiment was to show that by the removal of superfluous shoots (shoots between the ground and first wires, between the first and second wires, and non-fruiting shoots on the canes), conditions would be less favorable for the development of fungus diseases, less time would be required to prune, summer pruning would not be necessary, and that the practice would have a favorable effect on the yield of fruit.

The only notes available are that disbudding took one and one-half minutes per vine while summer pruning took on an average of three and one-half minutes per vine.



A. Ringing completed.
B. A "ring" that has partly grown over by fall.
C. A "ring" that has completely grown over by fall

Ringing Grapes.

Following is the outline of an experiment to ascertain the time at which grape vines may be ringed with the most resulting success. The ring will be removed from a part of the shoot just below the bunch and will be about one-third of an inch wide.

Ringing will be done at the following period, and on vines representing the five different systems of training practised in the vineyard:

1. One week before flowers open ten shoots will be ringed on two vines each of three different varieties trained according to the Kniffen system (two upper wires).

2. One week after flowers open ten shoots will be ringed on two vines each of three different varieties trained according to the Kniffen system (two lower wires).

3. Three weeks after flowers open ten shoots will be ringed on two vines each of three different varieties trained according to the Kniffen system (Imp.).

4. Six weeks after flowers open ten shoots will be ringed on two vines each of three different varieties trained according to the Horizontal Arm System.

5. Nine weeks after flowers open ten shoots will be ringed on two vines each of three different varieties trained according to the Fan system.

Row.	Vine.	Date of Ringing.	Variety.	No. of shoots ringed.	No. of bunches.	No. of shoots at close of season.	No. of bunches cut.	Date of cutting.
1	2	16/6/14	Concord.....	5	10	0		
	11		Campbell....	5	10	0		
	13		Lindley.....	5	15	0		
2	2		Concord.....	5	12	0		
	11		Campbell	5	10	3	5	13/8/15
	13		Lindley.....	5	14	0		

Remarks.

From the above results it will be seen that the ringing of canes at this time is not practical. The shoots, as in this case, will mostly be broken off by high winds; also, the very early ringing of canes does not appear to bring about a correspondingly early ripening of the grapes.

Row.	Vine.	Date of ringing.	Variety.	No. of shoots ringed.	No. of bunches.	No. of shoots at close of season.	No. of bunches cut.	Date of cutting.
4	2	8/7/15	Concord	6	12	6	12	18/8/15
4	11		Campbell....	2	4	2	4	11/8/15
5	11		Campbell....	5	9	4	8	13/8/15
5	12		Campbell....	4	8	4	8	13/8/15
4	14		Lindley.....	6	12	6	12	14/8/15
5	13		Lindley.....	5	12	5	12	16/8/15
5	3		Concord	1	3	1	3	18/8/15
5	4		Concord	2	4	1	2	18/8/15
5	4		Concord	2arms	11	2arms	11	13/8/15

Remarks.

Row 5, vine 11—One bunch.

Row 4, vine 2—Four bunches were ready to cut September 15.

Bunches on ringed arms were larger, berries were larger and ripened earlier and more uniformly than did the bunches and berries on non-ringed shoots.

Row.	Vine.	Date of ringing.	Variety.	No. of shoots ringed.	No. of bunches.	No. of shoots at close of season.	No. of bunches cut.	Date of cutting.
9	3	23/7/15	Concord	5	12	5	12	18/8/15
	4		Concord	5	12	4	11	18/8/15
	11		Campbell....	5	12	3	6	12/8/15
10	12		Campbell....	6	12	4	8	12/8/15
9	15		Lindley	3	7	2	5	13/8/15
10	15		Lindley	4	9	3	7	13/8/15

Row.	Vine.	Date of ringing.	Variety.	No. of shoots ringed.	No. of bunches.	No. of shoots at close of season.	No. of bunches cut.	Date of cutting.
3	2	2/8/15	Concord	5	12	5	12	13/8/15
	12		Campbell....	5	7	3	6	13/8/15
	13		Lindley	7	13	7	13	13/8/15
7	15		Lindley	5	13	5	13	
	12		Campbell....	5	8	4	6	13/8/15
	2		Concord	3	6	3	6	16/8/15
	1		Concord	2	4	2	4	16/8/15

Remarks.

Row 3, vine 12—One bunch taken September 6 before it had been thoroughly ripened.

As far as this year's results are concerned ringing may be done to the best advantage during the last ten days of July.

Small Fruits.

None of the newer varieties of raspberries or blackberries have been tested.

A plantation of the following varieties of currants and gooseberries has been built up since 1911:

Red and White Currants.

Cherry (1913).
Diploma (1912).
Fay (1912).
London (1912).
Perfection (1912).
Pomona (1912).
Prince Albert (1912).
Red Cross (1912).
Raby Castle (1912).
Victoria (1912).
Versaillaise (1912).
White Grape (1912).
White Imperial (1912).
Wilder (1912).

Black Currants.

Baldwin.
Black Naples.
Black Champion.
Boskop Giant.
Buddenburg.
Climax.
Clipper.
Collins Prolific.
Eagle.
Eclipse.
Kerry.
Lee.
Magnus.
Saunders.
Topsy.
Victoria.

Gooseberries.

Bright Venus (1915).
Broom Girl (1915).
Carrie (1915).
Champagne Red (1915).
Champagne White (1915).
Champagne Yellow (1915).
Crown Bob (1913).
Downing (1912).
Golden Gem (1915).
Green Casoigne.
Hedgehog (1915).
Houghton (1915).
Industry (1913).
Ironmonger (1915).
Josselyn (1915).
Keepsake (1913).
Keen Seedling (1915).
Lancashire Leader (1913).
Langley Beauty (1915).
Langley Gage (1915).
Leader (1915).
M. C. S. (1912).
Pearl (1912).
Pitmaston Green Gage (1915).
Red Jacket.
R. B. White's Seedlings, Nos. 3, 9, 10, 11, 12 (1915).
Smith (1915).
Triumph (1912).
Victoria (1912).
Whitesmith (1913).

No experiments are being conducted on these varieties. Some are used in breeding and improvement work.

Raspberries.

An attempt was made to irrigate three varieties of raspberries: Herbert, Cuthbert and Marlboro'. No increase was noted and where the soil was kept moist and the bushes somewhat wet from the spray and rain the fruit proved to be soft and unfit for shipment. Experience seems to indicate that the overhead system of irrigation is not practical for raspberries.

Some promising Seedlings from Prof. Macoun, C.E.F., Ottawa.

Strawberries.

The following varieties fruited in 1915: Sharpless, Cardinal, Bederwood, King Edward, Superb, L. Thompson, August Luther, Excelsior, Aroma, Gandy, Jerome, Jessie, New York, Enormous, Longfellow, Texas, Climax, Lovett, Splendid, Downing's Bride, Parson's Beauty, Orem, Cobalt, Three W's, Glen Mary, Highland Beauty, Pocomoke, Clyde, Crescent, Sample, Haverland, Nettie, Belt, Joe, Michael, St. Loui's Prize, Warfield, Dunlap, Williams.

The following were set out in the spring of 1915 and will fruit in 1916: Uncle Jim, Enhance, Ruby, Island King, Molena, Magoon, Goodell, Jocunda, Early Ozark, Heritage, Kellogg's Prize, Marshall, Commonwealth, Highland, Staples, Tennessee, Arizona, Helena Davis, Dornan, Fendall, Woolverton, Bubach, Ohio Boy, Chesapeake, Brandywine, Klondyke, Americus, Desdemona, Cassandra, Ophelia, Valeria, Vergilia, Mariana, Julia, Cordelia, Portia, Orem, Thompson's Seedling.

Notes are made on the vigor, hardiness, amount of bloom, blossoming dates, fruiting season, shipping quality, and other facts that might possibly be of value A short description is made of each variety. Detailed information is available on all varieties that fruited in 1915.

Irrigation Tests on Strawberries.

The varieties are so arranged when planted that one-half of each row can be irrigated regularly and the other half left dry. The plants in this test were carefully mulched in the fall of 1914 and the straw was raked into the row in the spring of 1915. The mulch was so arranged that it would retain the greatest possible amount of moisture. The irrigated plot yielded a total of 1,680 boxes and the non-irrigated part 1,495 boxes, an increase of 175 boxes or 10.1 per cent. Information is available on the amount of water applied and the approximate cost of application.

VEGETABLE GARDENING

Asparagus.

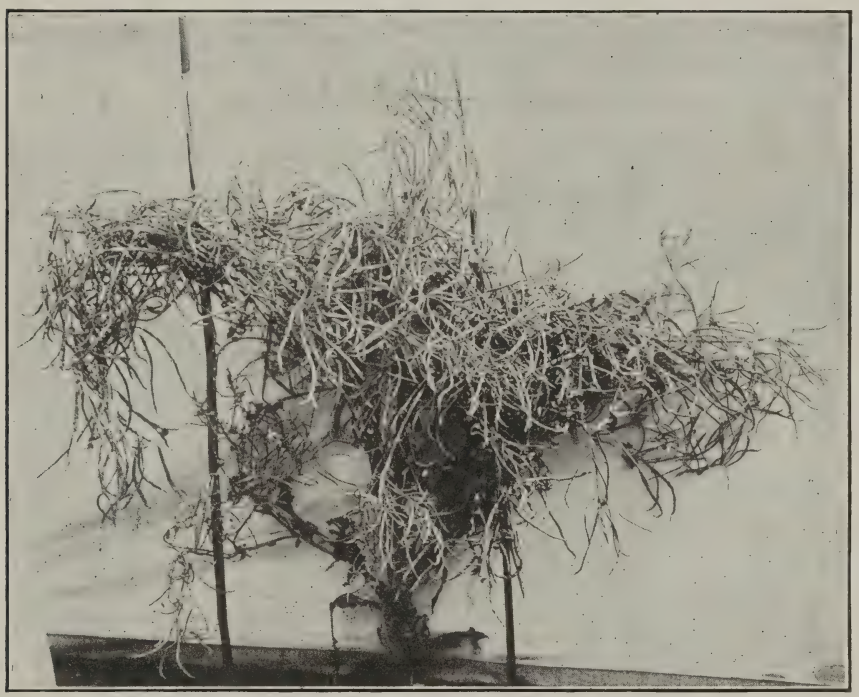
New plantings of asparagus were made in the springs of 1914 and 1915. In all, nine varieties or selections of varieties have been set out: Giant Argentueil, Dreer's Argentueil, Dreer's Connover's Colossal, Palmetto, "Lund's" Special, Barr's Mammoth, Dreer's Eclipse and Columbian White. These varieties are used for comparative yields, quality, disease resistance and general commercial value.

Asparagus Seedlings in flats ready for transplanting.

The value of irrigation on asparagus is also being tested. The plants for this experiment were set in the spring of 1914. In 1915 a total of 126 lbs. 5 oz. were cut from 1,015 plants. This cut is light but might be considered fairly heavy for the first year. The irrigated plants yielded 33.1 per cent. more than the non-irrigated plants. The gain from the irrigation apparently results from the water applied the previous season, as only one application of water was made during the cutting season. The increased vigor and growth from regular applications of water during the summer shows itself in the root during the harvest season the following spring.

Beets.

An attempt was made to test the value of irrigation on early beets. Water was applied at such times as the soil appeared to require it, but no advantage was gained. Temperature or soil heat is apparently more needed than water in early spring. Cultivation to conserve the moisture is apparently all the roots require to induce rapid growth in early spring. The soil, generally speaking, has an abundance of moisture up to the second or third week in June. The work is being continued with a portion of the plot treated with applications of nitrate of soda.



Cauliflower Seed. A single plant under glass.

Carrots.

The above remarks apply to carrots for early market also. For late use water increases the yield but because of the low price of the product does not warrant the application.

Celery.

Two tests are being carried on with celery. In the first case an abundance of water is supplied. The illustration shows the comparative difference when the irrigated plants were ready for use. In the second case, in addition to the water applications, nitrate of soda is applied at the rate of 200 lbs. per acre three times after the celery has made some growth. No increase in size or quality was noted from the use of nitrate of soda. The test might be considered a failure because a

large part of the planting was lost from heart rot near the completion of the test. The plants were set in single rows, double rows and beds. The tests are being continued.

Onions.

Only four varieties of onions are grown: Weathersfield, Yellow Danvers, Ailsa Craig and Prizetaker. The same tests were carried on as with the beets and carrots. No apparent gain was made in the rate of growth or early maturity from applications of water. When the crop was harvested in the fall there was a slight gain in total yield in favor of the non-irrigated plots. The irrigated plots were more subject to the attacks of mildew.

The best of the bulbs from these plots are selected for seed producing purposes.

Onions in bloom for seed.

Peas.

The work of selection on nine varieties of peas was started in 1914. Selections of Abundance, Alaska, Gradus, McLean's Little Gem, Thomas Laxton, Telephone, Gregory's Surprise, Champion of England and Horford's Market were made in 1914. All varieties, except two, registered an increase in the average number of pods and peas per vine in 1915. Selections were again made and it is hoped in this way to build up higher producing strains of these varieties. The method of selection is, however, doubtful and is deserving further study.

In connection with the work and studies on peas the varieties used by Gregor Mendel were also grown for crossing and study.

Potatoes.

Hill selections of potatoes were made in 1915 keeping in mind the following points:

(1) Most productive hills.

(2) Uniformity of tubers.

(3) Smooth skin and shallow eyes. In 1915 one other point was added to this:

(4) That of blight resistance.

The following varieties were used: Gertrude, Davies' Warrior, Raleigh, Carman No. 3, Delaware and Irish Cobbler.

The best hill from each hill selection of 1914 was saved in 1915 and the tubers will be planted whole in 1916 and any improvement again noted. This method of selection for improvement is also doubtful and is being enlarged for further study.

Potatoes, the product of a single hill. End hill is from one potato planted whole.

Tomatoes.

(1) The tomato work is largely seed selection for improvement. The following varieties have been selected for two years: Ruby, Earliest of All, Earliana, Alacrity, Atlantic Prize, June Pink, Dominion Day, Chalk's Jewel, Magnus, Golden Queen, Dwarf Aristocrat, Beauty, Bonny Best, Dwarf Champion, Livingstone's Favorite, Imperial, Success, Danish Export, Homer's Favorite, Plentiful, Ignotum, Ponderosa, Livingstone's Stone and Royal Red. With the hope of obtaining data that would be of value in making selections for certain characters, the following selections have been made for two years from each variety:

(*a*) Earliest fruit.
(*b*) Latest fruit from earliest plant.
(*c*) Most productive plant.
(*d*) Most uniform fruit regardless of individual plant.
(*e*) Most uniform fruiting plant.
(*f*) Smallest fruit.
(*g*) Largest fruit.
(*h*) All desirable mutants.

Twenty plants have been grown from each selection for one year. The selections were repeated in the fall of 1915 with which to continue the work in 1916. Careful records are made under the above heads including earliness, yield, uniformity, etc. The object is not only to develop strains by selection but if possible to determine the best means of selection for the desired result.

(2) The work is also carried beyond the field of production and selection in that the various varieties are tested for canning purposes under the division of by-products.

(3) At the request of Mr. W. A. McCubbin, some data was collected on the comparative yields of healthy and Mosaic disease affected plants. It was found that not only did the disease reduce the total yield per plant from an average of 13.6 lbs. per plant to 7.9 lbs. per plant, but that the number of fruits per vine and the size of each was reduced also.

Vegetable Seed Production.

Four varieties of onions, mostly Yellow Globe Danvers and Denia, with a few Red Weathersfield and Ailsa Craig, were planted in the spring of 1915. These were some distance from each other to prevent cross pollination. In addition to this, Detroit Dark Red beet and Chantenay carrot roots were planted for the production of seed.

Celery irrigated and non-irrigated.

From these were selected some good individual types from which to produce seed the following year. The seed was harvested during the latter end of September and first of October. The period of ripening was lengthened by the late season. The seed was clipped off by shears and placed in baskets or spread out on the packing house floor to dry. It was considered advisable to take the onion seed under cover to dry out, but the beet and carrot seed was hung outside on small racks, where it ripened and dried.

Threshing was done by means of hand flails and rubbing. A small mill with a complete set of screens was purchased to clean the seed. It was carefully weighed and stored for winter. Threshing was not completed until January. On a large scale, more complete and efficient means for threshing would be necessary to reduce the cost of production.

It was necessary also to wash the onion seed in order to separate the lighter and poorer seeds. Considerable difficulty was met with in getting the onion and carrot seed well rubbed out because no suitable threshing machine was available.

BEETS PLANTED APRIL 16, 1915

Row	*Black Detroit.* Selection	Weight lbs.	Number of Roots	Total weight of Seed	Yield of Seed per Root lbs.	Yield of Seed per lb. of Root
1	A. Small	42.5	145	31	.21	.73
2	B. Medium	72	181	25	.13	.34
3	C. Large	55	89	20	.22	.36
	Total		415	76 lbs.		

CARROTS PLANTED APRIL 16, 1915

	Chantenay.					
3	A. Large	52	76	8.5	.11	.16
2	B. Medium	86	176	5.75	.032	.07
1	C. Small	48	106	6.5	.061	.13
4	D. Culls	103	214	2.75	.012	.026
	Total			23.5 lbs. including stems and heads.		

Actual total after seed cleaned, 3.5 lbs. The waste due to various causes was very heavy in this case.

YIELD OF ONION SEED FROM SELECTIONS OF YELLOW GLOBE DANVERS

Selection	Weight	Number of Bulbs	Total Yield of Seed	Per lb. of Root	Yield of Seed per Bulb
Selection A.					
A. Large	41.25	94	1.5 lbs.	.3	.016
B. Medium	85.5	278	8	.09	.03
C. Small	6	28	.25	.04	.009
Selection B.					
D. Small	162.25	822	14.75	.09	.018
E. Very Small	20	147	5.25	.26	.04
F. Medium	79.25	270	4	.05	.015
Selection C.					
G. Medium	42.5	127	2	.05	.016
H. Small	26	117	5.75	.22	.049
H. Small	54.25	282			
No Name			3.5		

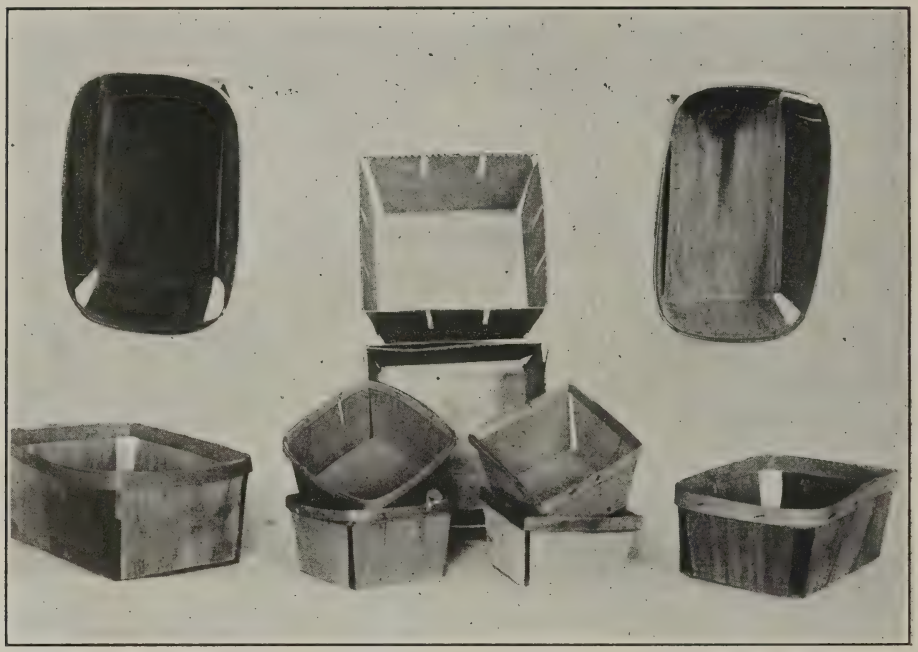
Total field 45 lbs. onion seed. Much of this was poor and light, and when washed the total quantity was reduced to 14.25 lbs.

Barn and Ice Cold Storage House.

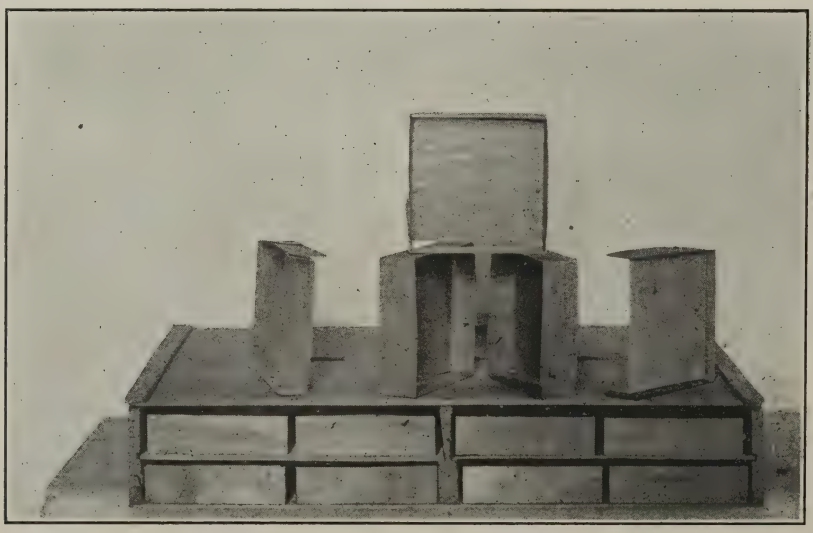
The Skinner Irrigation System and Experimental Plots.

For the Sailors and Soldiers of Freedom.

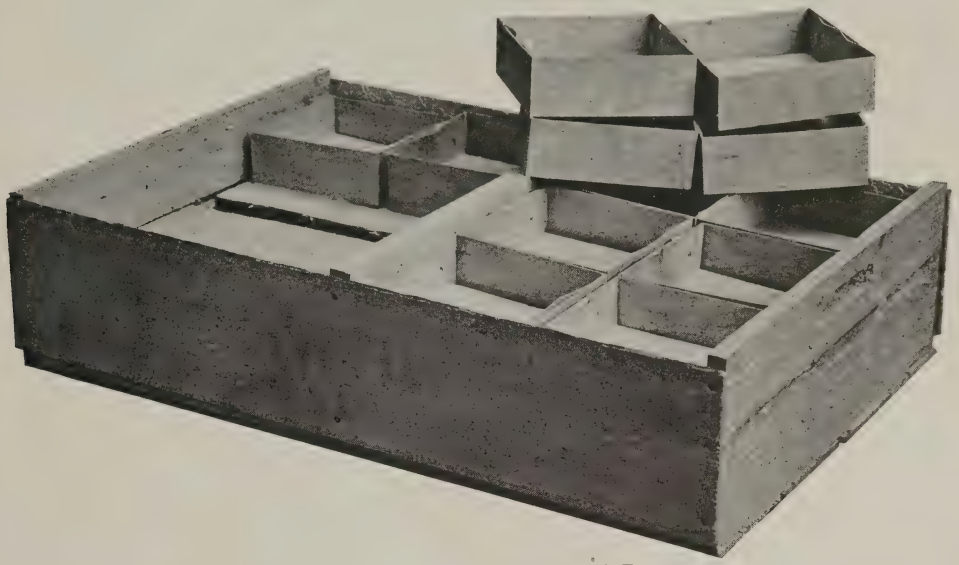
The Ice Harvest.



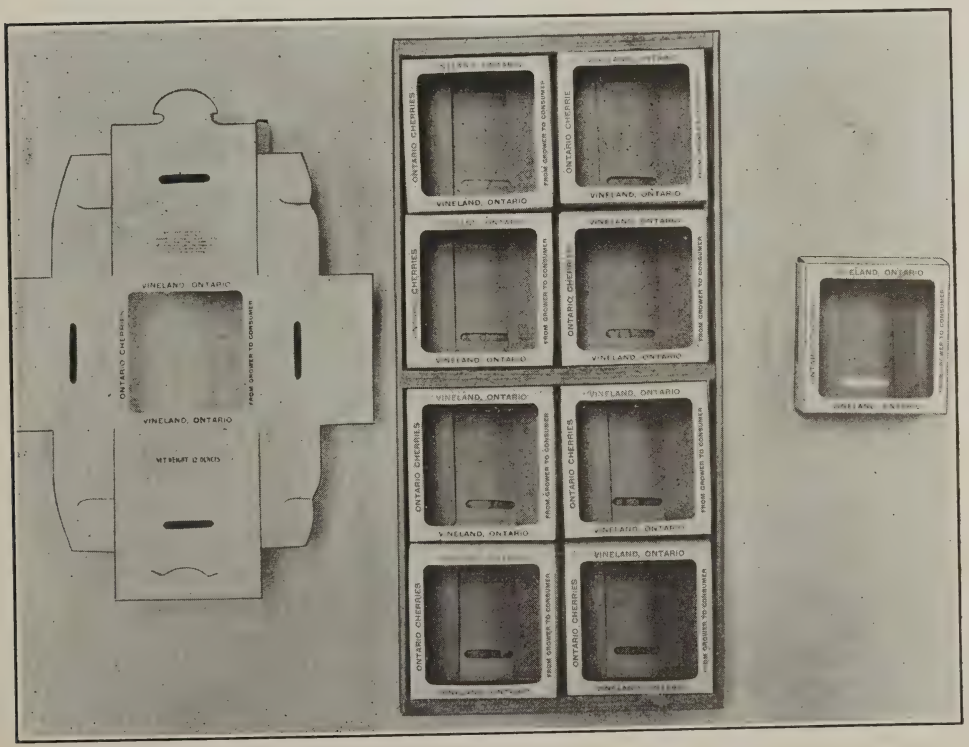
Some of the various containers used for berries, plums and tomatoes.



Boxes used for raspberries from British Columbia.



Western Raspberry Crate and Boxes.



Cardboard pound package and container used occasionally for fancy sweet cherries.

RESULTS OF GERMINATION TEST OF SEED.

January 27th, 1916.

Beets. Fifty seeds planted in each selection.

A. 34 sprouted, 72 young plants, 144 per cent.
B. 30 sprouted, 61 young plants, 122 per cent.
C. 25 sprouted, 47 young plants, 94 per cent.

Onions. The letters represent the various selections. Fifty seeds planted in each case.

A. 46 sprouted, 92 per cent.
B. 42 sprouted, 84 per cent.
D. 38 sprouted, 76 per cent.
E. 46 sprouted, 97 per cent.
G. 35 sprouted, 70 per cent.
H. 34 sprouted, 68 per cent.

Average, 81.1 per cent. germination.

Cabbage planted for seed production.

FALL *VS.* SPRING PLOWING.

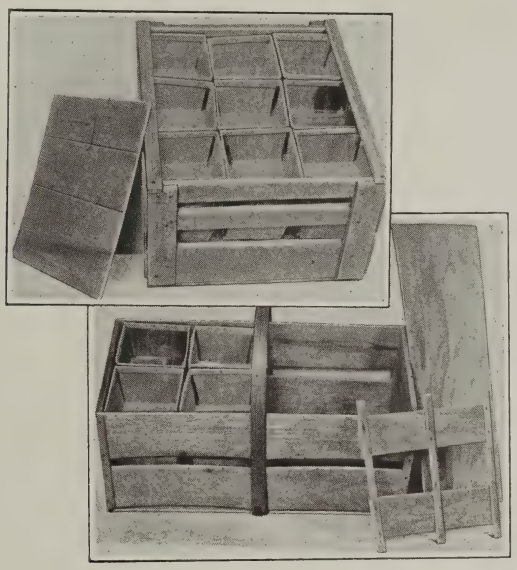
A section of apples, including a row of each of the following varieties: Canada Red, Gravenstein, Blenheim, Stark, Fameuse, Duchess, Cayuga, Wolf River, St. Lawrence, Ribston and Astrachan, has been interplanted with Dwarf Pears. Half of this section is fall plowed and half spring plowed, each part being treated the same year after year.

Three cover crops are used: rye and vetch at the rate of one bushel of the former and 20 lbs. of the latter; oats and red clover at the rate of one bushel of the former and 10 lbs. of the latter; and buckwheat at the rate of 1½ pecks per acre.

Notes have been made on the growth of the crop, growth of the trees, percentage of fruit set and quantity harvested. All losses from blight and other causes have been carefully noted. No data of value is available. The sections are equally good.

FRUIT PACKAGES.

Some special work has been done in collecting, studying and photographing the various packages that are used for fruit shipment and that ordinarily come into competition with Ontario packages in the open markets. Twenty-four distinct types were studied in all. This does not include the various types and shapes of any one basket, such as the various climax baskets, the various bushels or all the various berry crates.



Upper cut shows 27 qt. crate used altogether in the Clarkson district. The 24 qt. crate below is used largely in the Niagara district.

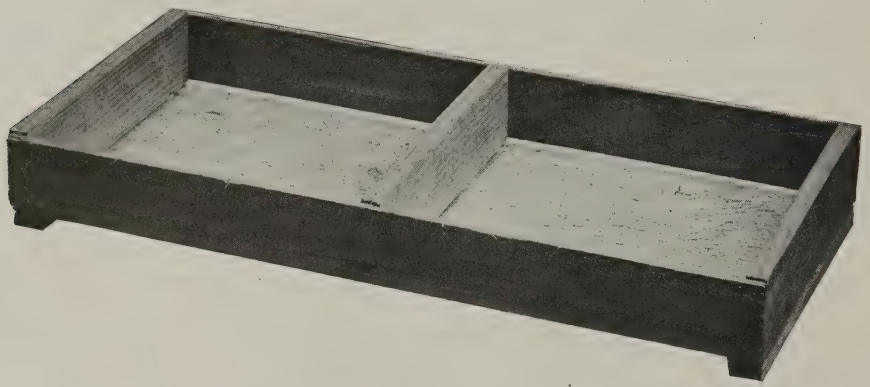
Trial shipments were made in bushel peach baskets, the standard peach box and in the four basket plum case (apricots and tomatoes), but the work has not advanced far enough to report.

APIARY.

The farm maintains an apiary of about forty colonies. This is gradually being reduced. Only a few colonies are being retained to ensure blossom fertilization.

BY-PRODUCTS.

The by-products work was started in July with the appointment of Mr. P. E. Culverhouse to take charge. The summer has been spent largely in studying the situation with regard to jams, syrups, canned goods and similar products and in getting in touch with the situation as far as the available fruits for such purposes are concerned. Also a large room in the Administration Building has been reconstructed and equipped in part for use as a working laboratory.



The cherry box without cartons, as usually used. The first layer is neatly faced and the box then filled without any further attempt at arranging the fruit in layers.

The farm has as part of its general equipment a small canning plant 30 ft. x 30 ft. This has been overhauled and the machinery put in shape, and during the season was used entirely for the canning of fruits, principally peaches, for the hospitals in Britain and France. This work cut heavily into the original plans as outlined, but was cheerfully done with the hope of adding, even in a small way, to the cheer of the wounded in the hospitals. The canning work is to be continued, but at the same time the by-products work will be given as much attention as possible.

CONCLUSION.

The Director desires to express his appreciation and thanks to those who have assisted so ably in the compilation of this report. All experiments are not reported fully, but it is hoped that enough is given in each case to enable the reader to understand the work in hand. Any question on any experiment will be cheerfully answered.

Thinning of apples on large trees in Ontario is still an experiment.

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